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POLITICAL ESSAY

ON THE

KINGDOM OF NEW SPAIN.

CONTAINING

Researches relative to the Geography of Mexico, the Extent of its Surface and its political Division into Intendancies, the physical Aspect of the Country, the Population, the State of Agriculture and Manufacturing and Commercial Industry, the Canals projected between the South Sea and Atlantic Ocean, the Crown Revenues, the Quantity of the precious Metals which have flowed from Mexico into Europe and Asia, since the Discovery of the New Continent, and the Military Defence of New Spain.

BY ALEXANDER DE HUMBOLDT.

FOUNDED ON ASTRONOMICAL OBSERVATIONS, AND TRIGONOMETRICAL AND BAROMETRICAL MEASUREMENTS.

TRANSLATED FROM THE ORIGINAL FRENCH,

BY JOHN BLACK.

VOL. I.

NEW-YORK:

Printed and published by I. Riley.

1811.

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MEXICO
THE TWO REPUBLICS
ED. W. CLARKE

PREFACE BY THE TRANSLATOR.

It is observed by a popular French writer, Bernardin de St. Pierre, that by far the most valuable and entertaining part of modern literature is the department filled up by travellers. While the knowledge of the ancients extended merely to a small circle around them, and even there was far from accurate, there is hardly a nook in the most remote corner of the world of which we do not now possess some description, and with the inhabitants of which we are not more or less acquainted. We see the human race before us in every stage of civilization, from the refinement and enterprise of the inhabitants of the west of Europe, down to the stupid savage of New Holland, or the Terra del Fuego.

The eagerness with which the public have always received the accounts of travellers has naturally contributed to their multiplication. It is to be regretted, however, that this eagerness is too frequently so indiscriminate that almost nothing is so very insipid that it will not be devoured in the shape of travels. Hence the numerous productions which have appeared of late without adding any thing to our stock of information. No individual now who has left the bounds of our own island, hesitates a moment about the qualifications necessary for his appearance before the public at his return. His previous education, his means of access to proper sources of information, and

his leisure to acquire it, are objects of inferior concern. He has travelled, and that is enough.

M. de Humboldt belongs to a higher order of travellers, to whom the public have of late been very little accustomed. We must place him beside a Nieubuhr, a Pallas, a Bruce, a Chardin, a Barrow, and a Volney; and his works will probably be long consulted as authorities respecting the countries which he describes. He seems to be a stranger to few departments of learning or science; and his fortune enabled him to provide himself with every thing which could most advance his pursuits, and to make that appearance among persons of rank and authority necessary to remove the obstacles in the way of a traveller in every country, but most of all in a country under an arbitrary government.

The work of which a translation is here offered to the public was submitted to a very severe trial: the sketch of it was freely communicated to the natives of New Spain, and underwent the examination of the Spanish government. It may be doubted, however, whether the accuracy and fulness of information which such a measure has a tendency to procure might not be counterbalanced by seemingly unavoidable disadvantages. We never talk of our friends so candidly before their faces as behind their backs. In the former case we may say nothing but the truth, but we are seldom disposed to say the whole truth. He must be a very honest traveller indeed who communicates all the remarks which occur to him, to the people among whom he is travelling. Even Dr. Johnson, with all his bluntness, would have hesitated to read his Tour to the Hebrides to his Scotch landlords.

There is one disadvantage indeed almost inseparable from the mode in which M. de Humboldt appears to have

been treated in the new world. He received so much attention both from public men and private individuals during his stay in Mexico, that he could hardly avoid displaying some portion of gratitude in return. We accordingly find him exceedingly prone to give favourable accounts of all the individuals of that country whom he has occasion to mention. He is profuse in his compliments to their learning, science, and their other good qualities, and nothing ever appears to shade the picture. We may easily conceive, therefore, that he must have seen both in individuals and institutions much more that met with his disapprobation than he has chosen to communicate.

M. de Humboldt has brought forward a great mass of information regarding New Spain, a country of which we before knew very little indeed. Let the specious paragraphs of our celebrated countryman Robertson be attentively weighed, and we shall be astonished to find how little specific information they sometimes really contain. The present work, however, furnishes us with precise data on a very great variety of important subjects. Yet it is to be regretted that the author could not throw occasionally more rapidity into his descriptions, and give somewhat more condensation to his materials. He is sometimes rather apt to indulge in repetition, and to swell his accounts with circumstances by no means essential to be told, but which have a necessary tendency to fatigue the attention of the reader. This failing is not peculiar to M. de Humboldt, but is common to him with too many authors, and particularly those of his own country, Germany. Indeed the faculty of selecting the more important and leading features of an object is, perhaps, the rarest and most valuable which any writer can possess. It is this which commu-

nicates such a charm to the history of Hume, and arrests so strongly our attention in the travels of Volney.

But whatever may be the sentiments of the translator on this subject, it is not for him to endeavour to alter his original to what he conceives a model of perfection. The public naturally wish to have his information in his own manner, and as nearly in his own terms as possible. It were well if even this was tolerably done; but the rapidity with which translations like the present must necessarily be executed, will not admit of that flow and correctness of style which the leisure of the closet might produce. When we sit down to the translation of an established classic, we may patiently endeavour to transfuse the beauties and graces of the original into our own language; but the translation of a work like this, impatiently expected by the public, must lay claim to a very inferior degree of merit.

A few notes have been occasionally thrown in by the translator, which he has not the vanity to suppose of any great importance; but as they do not in general occupy much room, and as they served to amuse him in the course of the work, he hopes if they do not meet with the reader's approbation, they will, at least, meet with his indulgence. In one of them, in vol. i. he observes that he has completely misunderstood the author, a circumstance certainly not the more justifiable, because it is by no means unusual with commentators.

The translator has been at some pains in ascertaining the value of the different foreign measures, weights, and moneys, used by the author, and converting them into those of our own country. The omission of this is but too frequent in translations, though it is essential to any work which aims at being generally understood. These con-

rmions, however, appear only in the notes, the original having undergone no alteration.

The orthography of the names has been preserved in the translation with few exceptions. The Spanish names of persons and places have never been touched, but in a few names of Indian nations, such as *Azteques*, *Tolteques*, &c. the *ques* has been converted into *cs*, the corresponding termination in our own language. Clavigero uses the same freedom in the Italian, writing these words *Aztecchi*, *Toltecchi*, &c. This liberty is perhaps justifiable, though it might not be advisable to go all the length recommended by Volney, in whose work on North America we can with difficulty recognise the names most familiar to us. Who, for instance, could find out *Washington* in *Ouachinnetone*? The various sounds given to the same letters by the different European nations occasion a good deal of perplexity. The same name assumes quite a distinct appearance in the works of a French and an English traveller. Another source of perplexity peculiar to the Spaniards and Germans is the indiscriminate use of certain letters. The Spaniard, for example, confounds the *b* and the *v*; the *ç* and the *z*; the *j*, the *g*, and the *x*; and they write the same word sometimes with one of these letters, and sometimes with another. It is necessary to give this caution to the reader, who, were he to meet with *Xuan de Grixalba* in one place, and *Juan de Grijalva* in another, might not at first perceive the identity. M. Pinkerton, who seems to plume himself not a little on his orthography, observes, that the Spanish, French, and Italian writers, write Motezuma; the English alone Montezuma; and he of course must follow the Spanish, French, and Italian writers. Why the English are bound to follow the orthography of these nations it is not so easy to conceive, any more than

that they should follow the English, the proper orthography being neither Motezuma nor Montezuma, but Moteuczoma. M. de Humboldt sometimes inserts the *n* and sometimes leaves it out.

A considerable part of the Essay on New Spain has not yet arrived in this country; but, when it does arrive, no time will be lost in communicating it to the public, if the portion now presented shall meet with a favourable reception. The most important of the maps and drawings in the part which we have received appear in the present publication, but on a more economical scale. Of the maps and physical sections it is sufficient to say, that they have been executed under the care of Mr. Lowry, whose well known taste and skill so justly entitle him to the public confidence. It would have been foolish to attempt to imitate the magnificence of the original; but it will be found that nothing of essential importance has been omitted. The publishers wished to spare no necessary expense in the present publication; but they were averse from increasing the price of a book intended for general circulation by an ostentatious and injudicious splendour.

TO

HIS CATHOLIC MAJESTY

CHARLES IV.

KING OF SPAIN AND THE INDIES.

SIRE,

HAVING enjoyed in the distant regions subject to your sceptre the protection and kind offices of your Majesty during a long succession of years, I fulfil only a sacred duty in laying at the foot of your throne the homage of my profound and respectful gratitude.

I had the good fortune to be introduced to your Majesty in 1779 *at Aranjuez. You deigned to applaud the zeal of a private individual, whom the love of science conducted to the banks of the Orinoco and the summits of the Andes.*

It is through the confidence which your Majesty's favours have inspired in me that I venture to place your august name at the head of this work. It contains the description of a vast kingdom, the prosperity of which is dear to your heart.

None of the monarchs who have occupied the Castilian throne have contributed more liberally than your Majesty to the obtaining accurate information regarding the state of that valuable portion of the globe, which in both hemispheres yields obedience to the Spanish laws. The coasts of America have been surveyed by able astronomers with a munificence worthy of so great a sovereign. Accurate maps of these coasts, and even minute plans of several military positions, have been published at the expense of

your Majesty; and you gave orders that there should be annually published in a Peruvian journal at Lima, a state of the commerce, finances, and population.

There was still wanting a statistical essay on the kingdom of New Spain. I digested the great number of materials which I possessed into a work, of which the first sketch drew the attention of the viceroy of Mexico in a manner which redounded to his honour. I should be happy if I could flatter myself that my feeble efforts, under a new form, and more carefully digested, are not unworthy of being presented to your Majesty.

They breathe the sentiments of gratitude which I owe to the government who protected me, and to the noble and loyal nation who received me, not as a traveller, but as a fellow-citizen. How can we displease a good king, when we speak to him of the national interest, of the improvement of social institutions, and the eternal principles on which the prosperity of nations is founded?

I am, with the greatest respect,
Sire,
Your Catholic Majesty's very humble
And very obedient servant,
THE BARON DE HUMBOLDT.

Paris 8th March, 1808.

CONTENTS.

Geographical introduction. Vol. i. p. i.

BOOK I.

General considerations on the extent and physical aspect of the kingdom of New Spain. Influence of the inequalities of the soil on the climate, agriculture, commerce, and military defence of the country.

CHAPTER I.

Extent of the Spanish possessions in America. Comparison of these possessions with the English colonies, and with the Asiatic part of the Russian empire. Denominations of New Spain, and of Anahuac. Boundary of the empire of the Aztec kings Vol. i. p. 5.

CHAPTER II.

Configuration of the coast. Points where the two seas are least distant from one another. General considerations on the possibility of uniting the South Sea and Atlantic Ocean. Rivers of Peace and Tacoutche-Tesse. Sources of the Rio-Bravo and Rio-Colorado. Isthmus of Tehuantepec. Lake of Nicaragua. Isthmus of Panama. Bay of Cupica. Canal of Choco. Rio-Guallaga. Gulf of St. George. Vol. i. p. 13.

CHAPTER III.

Physical aspect of the kingdom of New Spain compared with that of Europe and South America. Inequalities of the soil. Influence of these inequalities on the climate, cultivation, and military defence of the country. State of the coasts. Vol. i. p. 35.

BOOK II.

General population of New Spain. Division of the inhabitants into castes.

CHAPTER IV.

General enumeration in 1793. Progress of the population in the ten following years. Proportion of births to burials. Vol. i. p. 67

CHAPTER V.

Maladies which periodically arrest the progress of population Small-pox, natural and inoculated. Cow-pox. Matlazahuatl. Famine. Health of miners. Vol. i. p. 83.

CHAPTER VI.

Diversity of casts. Indians or indigenous Americans. Their number and their migrations. Diversity of languages. Degree of civilization of the Indians. Vol. i. p. 97.

CHAPTER VII.

Whites, Creoles, and Europeans. Their civilization. Inequality of their fortunes. Negroes. Mixed casts. Proportion between the sexes. Longevity according to the difference of races. Sociability. Vol. i. p. 153.

BOOK III.

Particular statistical account of the intendancies of which the kingdom of New Spain is composed. Their territorial extent and population.

CHAPTER VIII.

Of the political division of the Mexican territory, and the proportion of the population of the intendancies to their territorial extent. Principal cities. Vol. i. p. 199.

VOLUME SECOND.

BOOK IV.

State of the agriculture of New Spain. Metallic mines.

CHAPTER IX.

Vegetable productions of the Mexican territory. Progress of the cultivation of the soil. Influence of the mines on cultivation. Plants which contribute to the nourishment of man. Vol. ii.

GEOGRAPHICAL INTRODUCTION.

IN publishing maps of New Spain, differing in many respects from any which have hitherto been published, it is incumbent on me to give some account to astronomers and naturalists of the materials which I have employed. When an author makes nothing more than a compilation; when he draws from sources not generally known, and merely collects what is scattered in printed works or engraved maps, a simple nomenclature of the articles employed may serve for analysis. It is otherwise when a map is founded on the astronomical observations or measurements of an author himself; when he has had recourse to plans and manuscript notes preserved in archives or buried in convents. In the latter case, which is mine, the geographer has a right to demand a satisfactory exposition of the means employed for verifying the position of the most important points. In offering this exposition to the public, I shall carefully distinguish the results of simple combinations, from what has been immediately deduced from astronomical observations, and geodaæsical or barometrical measurements made on the spot. I shall endeavour to give a succinct analysis of the materials which I had at command, reserving, however, the purely astronomical details for the collection of observations and measurements which I published conjointly with M. Oltmanns. In following this course, the different parts of my work, the statistical account of Mexico, the historical relation of my journey in

the tropics, and the astronomical volume, will all serve, I flatter myself, to prove that a desire of accuracy and the love of truth have been my guides during the course of my expedition. May my feeble labours contribute something to dispel the darkness which for so many ages has covered the geography of one of the finest regions of the earth!

1. REDUCED MAP OF THE KINGDOM OF NEW SPAIN.

I DREW up this map at the Royal School of Mining (*Real Seminario de Mineria*) in the year 1803, a short time after my departure from the city of Mexico. M. d'Elhuyar, director of this school, had long been collecting facts regarding the position of the mines of New Spain, and the thirty-seven districts into which they are divided, under the denomination of *Deputaciones de Minas*. He was desirous of having a detailed map, on which the most interesting mines were marked, constructed for the use of the supreme college, called *Tribunal de Mineria*. A labour of this nature was in fact very necessary, both for the administration of the country, and for those who wish to know its national industry. In vain do we seek in the greater number of maps published in Europe for the name of the city of Guanaxuato, which contains 70,000 inhabitants; or for that of the celebrated mines of Bolanos, Sombrerete, Batopilas, and Zimapan. None of the maps which have hitherto appeared show the position of the *Real de Catorce* in the intendancy of *San Luis Potosi*, a mine from which there is annually drawn nearly 20 millions of francs* of silver; and which from its proximity to the *Rio del Norte*, appears already to have tempted the cupidity of

* 833,400*l.* sterling. *Trans.*

several colonists recently established in Louisiana. Having begun to calculate the greater number of my astronomical observations, that I might have some fixed points on which others could be established, and having at my disposal a considerable number of materials and manuscript maps, I conceived the idea of extending the plan which I had at first formed. Instead of merely inserting in my map the names of three hundred places known for considerable mining undertakings, I proposed to unite together all the materials which I could procure, and to discuss the differences of position which these heterogeneous materials every instant presented. We ought not to be surprised at the uncertainty which prevails in the geography of Mexico, when we consider the fetters which have arrested the progress of civilization, not only in the colonies, but also in the mother country; and especially when we consider the long peace enjoyed by these countries since the commencement of the sixteenth century. In Hindostan, the wars with Hyder Ally and Tippoo Sultan, the continual marches of armies, and the necessity of seeking the shortest communication, have singularly contributed to augment geographical information. And yet an accurate acquaintance with Hindostan, a country visited by the most active nations of Europe, does not extend farther back than thirty or forty years. I ought to have foreseen, that, notwithstanding the most assiduous labour during three or four months, I could only give a very imperfect map of Mexico, compared with the maps of the most civilized countries of Europe. This idea, however, did not discourage me. When I considered the advantages afforded me by my individual situation, I had to flatter myself that my work, notwithstanding the important faults which might disfigure it, would still be preferable to what has yet been offered to the public on the geography of New-Spain.

It will be said, without doubt, that it is yet too soon to draw up general maps of a vast kingdom for which exact data are wanting. But, for the same reason we should, with the exception of the province of Quito and the United States, publish no map of the interior of continental America. For the same reason, also, we should not yet construct maps of many parts of Europe, of Spain, for example, or Poland, countries in which, on surfaces of more than 1,600 square leagues, there is not to be found a single place whose position has been fixed by astronomical means. It is not yet fifteen years since, in the centre of Germany, there were hardly twenty places the longitude of which was determined with certainty to within a sixth or an eighth part of a degree.

In the part of New Spain situated to the north of the parallel of 24°, in the provinces called *Internas*, (in New Mexico, in the government of Cohahuila, and in the intendancy of New Biscay,) the geographer is reduced to form combinations from the journals of routes. The sea being at a great distance from the most inhabited part of these countries, he has no means to connect together places situated in the interior of a vast continent, with points on the coast a little better known. Hence, beyond the city of Durango, we wander as it were in a desert, notwithstanding the show of manuscript maps. There are not more resources to be found than Major Rennel possessed for drawing up maps of the interior of Africa. It is otherwise in the part of Mexico contained between the ports of Acapulco and Vera Cruz, and between the capital of Mexico and the Real* of Guanaxuato. In this region, traversed by me from the month of March, 1803, to the month of February,

* The word *Real* indicates a place where mines are worked.

1804, a region the most cultivated and best inhabited of the kingdom, there are to be found a sufficient number of points of which the position is astronomically determined. It is to be wished that a traveller, versed in the practice of observations, and provided with a sextant, or a small repeating circle of reflection, a chronometer, an achromatic telescope and a portable barometer for measuring the height of mountains, should travel in three directions over the north of the kingdom of New Spain. He should direct his course 1st, from the city of Guanaxuato to the *presidio* of *Santa Fe*, or to the village of Taos in New Mexico; 2d, from the mouth of the Rio del Norte, which pours its waters into the gulf of Mexico, to the sea of Cortez, particularly to the junction of the Rio Colorado and the Rio Gila; and, 3d, from the city of Mazatlan, in the province of Cinaloa, to the city of Alta Mira, on the left bank of the Rio de Panuco.

The first of these three journeys would be the most important, the easiest to execute, and that in which the chronometer would be exposed to the smallest changes of temperature. It would be useful, however, not to rely altogether on the mere lapse of time, but to employ for determining the longitudes, the satellites of Jupiter, eclipses, and especially the distances from the moon to the sun, means which, since the publication of the excellent tables of Delambre, Zach, and Bürg, merit the highest degree of confidence. In the astronomical journey from Mexico to Taos, the position would be verified which I have assigned to St. Juan del Rio, to Queretaro, Zelaya, Salamanca, and Guanaxuato; the longitudes and latitudes would be determined of S. Luis Potosi, Charcas, Lacatecas, Fresnillo and Sombrerete, five places celebrated for the riches of their mines; and the passage would lie through the city of Durango and the Parral at Chihuahua, the residence of the governor

of the *Provincias Internas.* In following the Rio Bravo, the traveller would pass along by the Passo del Norte, to the capital of New Mexico, and from thence to the village of Taos, the most northern point of this province.

The second journey, the most severe of all, and in which the observer is exposed to a burning climate, would supply fixed points in the new kingdom of Leon, in the province of Cohahuila, in New Biscay, and in Sonora. The operations should be directed from the mouth of the Rio Bravo del Norte, through the episcopal seat of Monterey, to the presidio of Moncloya. Pursuing the route by which the Chevalier de Croix, viceroy of Mexico, arrived in 1778, in the province of Texas, he would reach Chihuahua to connect the second journey with the first; from Chihuahua he would pass by the military establishment (presidio) of S. Buena Ventura, to the city of Arispe, and from thence, either by the presidio of Tubac, or by the missions of the Primeria alta, or across the savannahs inhabited by the Apachestontos Indians, to the mouth of the Rio Gila.

The third excursion, in which he would traverse the kingdom from Alta Mira to the port of Mazatlan, would be connected with the first by the city of Sombrerete; it would serve, by a winding to the north, to fix the position of the famous mines of Catorce, of Guarisamey, Rosario and Copala. A few days would suffice to determine the latitude and longitude of every place we have named. Only the most considerable cities, such as Zacatecas, S. Luis Potosi, Monterey, Durango, Chihuahua, Arispe, and Santa Fe of New Mexico, would occasion a stay of a few weeks. The astronomical means here indicated, easily afford, although the observer should not possess a very extraordinary ability, a certainty of

30 seconds* for the latitude, and of a third of a minute in time for the absolute longitude. How many considerable cities are there in Spain, and in the most eastern and northern parts of Europe, which are still far from this accuracy of geographical position!

The very trifling expense of the execution of these three journeys, above all of the first, would give a new face to the geography of New Spain. The positions of Acapulco, of Vera Cruz and Mexico, have been repeatedly verified by the operations of Galiano, of Espinosa and Cevallos, of Gama and Ferrer, and by my own. The officers of the royal marines stationed at the port of San Blas, could in a single excursion fix the important positions of the mines of Bolanos and of the city of Guadalaxara. The astronomical expedition which the government has intrusted to MM. de Cevallos and Herera, for surveying the coast of the gulf of Mexico, will determine the mouth of the Rio Huasacualco to the south-east of Vera Cruz. It would be easy for these able astronomers, who are provided with superb English instruments, to ascend this river, to

*One of our most celebrated astronomers observes with truth, that even at this day, since the introduction of repeating circles, there are not three places of the earth the latitude of which is known *with* the *certainty of a second*. In 1770, the latitude of Dresden was nearly three minutes false: that of the observatory of Berlin was uncertain till 1806, for nearly 25 seconds. In 1790, before the observations of Messrs. Barry and Henry, the position of the observatory of Manheim was false by a minute and 21 seconds of latitude, and yet father Christian Mayer had observed with a quadrant of Bird of 8 feet radius. (*Ephemerides de Berlin*, 1784, p. 158. and 1795, p. 96.) Before the observations of Le Monnier, we were ignorant of the true latitude of Paris for nearly 15 seconds. The astronomical journal of M. de Zach offers examples which serve to prove that an exercised observer, provided with a good sextant and an exact artificial horizon, may find the true latitude of a place to within seven or eight seconds.

which the project of a canal of communication between the Atlantic and South Seas has given such celebrity; they would determine the breadth of this Mexican isthmus, in fixing the position of the port of Tehuantepec and at the bar of S. Francisco at the mouth of the Rio Chimalapa.

The means which I propose in this memoir could be easily carried into execution at a small expense. There does not exist on the globe a country affording greater advantages for trigonometrical operations. The great valley of Mexico, the vast plains of Celaya and Salamanca, level as the surface of the waters which appear to have covered their soil for a long succession of ages; these plains, elevated 1,700 metres* above the level of the ocean, and bounded by mountains visible at great distances, invite the astronomer to the measurement of several degrees of latitude towards the northern limits of the torrid zone. In the intendancy of Durango, in a part of that of S. Luis Potosi, triangles of an extraordinary extent might be traced over a surface covered with grasses, and bare of wood; but to undertake the trigonometrical survey of the kingdom of New Spain, to wish to extend delicate operations over a surface five times larger than France, is to prevent the government from ever possessing a general map of its rich dominions, and to engage the court of Spain in a brilliant undertaking, but an undertaking of too great extent to be ever carried into complete execution. The scrupulous accuracy with which the officers of the Spanish marine examined the smallest sinuosities of the coast of South America has been censured.† This

* About 5,570 feet. *Trans.*

† One of the most learned geographers of the age, Major Rennel, observes that the English possess very exact charts of the anchorages on the coast of Bengal, while there does not exist any thing like a tolerable chart of the English channel. (*Description of Hindostan*, vol. 1. *Preface.*)

work was undoubtedly both laborious and expensive; it appears to me, however, that it is unreasonable to blame those who presented to his catholic majesty so admirable a project of hydrographical survey. A marine chart can never be too minute. The safety of navigation, the facility of recognising landing places, the necessary means of defence against an enemy who threatens disembarkation, all depend on the most intimate acquaintance with the coast, and with the bottom of the sea. In the interior of a country it is sometimes of small consequence that the position of a city be exactly laid down to a minute of latitude; but on the coast it is of the utmost importance to know the position of a cape, with all the accuracy which astronomical means admit of. In a hydrographical chart all the points should be equally well determined; for every one of them may serve as a point of departure or observation; and there is none which is not connected with others: while, on the contrary, the maps which represent the interior of a country possess great merit, when they offer a certain number of places whose position has been astronomically fixed.

If it is desirable that the Spanish possessions in the interior of America should not be for some time surveyed with the same minute accuracy which has been displayed on the coast; if in the actual state of things it would be more useful merely to execute a provisory undertaking, founded on the use of sextants and chronometers, on lunar distances, on observations of satellites, and eclipses, it would be of no less importance to unite to these purely astronomical means such other means as are furnished by the nature of the country, and the great elevation of its insulated summits. When we know exactly the absolute height of these summits, whether by means of the barometer, or by geometrical operations, angles of altitudes and azimuths taken with the rising or set-

ting sun may serve to connect these mountains with points whose latitude and longitude have been sufficiently verified. This method furnishes perpendicular bases; and in estimating how much we may be deceived in the measurement of each base, it is easy to conclude by false suppositions what influence this error may have on the astronomical position either of the mountain itself, or of the other points which depend on it. An exact knowledge of the inferior limit of perpetual snow will often afford the same advantages as the measurement of an insulated summit. This is the method employed by me to verify the difference of longitude between the capital of Mexico and the port of Vera Cruz. Two great volcanoes, that of la Puebla, called Popocatepetl, and the peak of Orizava, both visible from the platform of the ancient pyramid of Cholula, serve to connect two places distant from one another more than 16,000* toises. The union of two geometrical measurements of the mountains, of the azimuths and angles of altitudes calculated by M. Oltmanns, have given the port of Vera Cruz 0^h 11′ 32″ to the west of Mexico, while from purely astronomical observations there results a difference of meridians of 0 11′ 47″. In modifying the former result by several secondary operations at the pyramid of Cholula, we find even 0^h 11′ 41, 3″; so that in this particular case, on a distance of three degrees, the method of azimuths was only 7″ false in time.†

These same insulated summits, situated in the midst of a vast plain, offer a still surer method of determining in a short space of time, to within a few seconds, the longitude of a great number of neigh-

* About 102,400 feet English. *Trans.*

† Mémoire astronomique sur la différence des méridiens entre Mexico et Vera Cruz, par MM. Oltmanns et Humboldt. (*Zach*, Monathliche Correspondenz, Novemb. 1806, p. 445. Vol. 4. 459.)

bouring places. Luminous signals, produced by the deflagration of a small quantity of gunpowder, may be observed at great distances by persons provided with proper means for finding and preserving the true time. Cassini de Thury and Lacaille were the first who successfully employed this method of luminous signals. M. de Zach has recently proved by his operations in Thuringia, that in favourable circumstances it will furnish in a few minutes positions comparable for accuracy to the results of a great number of observations of satellites or solar eclipses. In the kingdom of New Spain the signals might be given at Iztaccihuatl, or Siera Nevada of Mexico; on the rock called The Monk, an insulated summit of the volcano of Toluca, which I reached 29th September, 1803; on la Malriche near Tlascalar; on the Coffre de Perotte; and on other mountains whose summits are accessible, and which are all elevated more than from three to four thousand metres* above the level of the sea.

The Spanish government having with extraordinary liberality made the most important sacrifices for the perfection of nautical astronomy, and for accurate surveys of the coast, we may expect that its next concern will be the geography of its vast American dominions, for which the royal marine would furnish both instruments, and astronomers skilled in observations. The school for mines of Mexico, in which mathematics are studied in a solid manner, spreads over the surface of this vast empire a great number of young men animated with the noblest zeal, and capable of using the instruments with which they might be intrusted. It is by analogous means that the English East-India Company have surveyed a territory whose surface equals that of England and

* From 9,840 to 13,120 feet English. *Trans.*

France united.* We live no longer in times when governments dread to expose to foreign nations their territorial wealth in the Indies. The present king of Spain gave orders to publish at the expense of the state, the survey of the coasts and ports; without fearing that the most minute plans of the Havannah, of Vera Cruz, and the mouth of the Rio Plata, should fall into the hands of the foreign nations whom events have made enemies of Spain. One of the finest maps, drawn up by the Deposito Hydrografico of Madrid, contains the most valuable details regarding the interior of Paraguay; details founded on the operations of the officers of the royal marine employed to settle the boundaries between the Portuguese and Spaniards. With the exception of the maps of Egypt and of some parts of the East Indies, the most accurate work which exists of any European continental possession out of Europe, is the map of the kingdom of Quito, drawn up by Maldonado. Every thing proves, that for these fifteen years past the Spanish government, far from dreading the progress of geography, has published all the interesting materials which it possessed on the colonies in the two Indies.

Having indicated the means, apparently the most proper, for speedily completing the maps of the kingdom of New Spain, I shall give a succinct analysis of the materials employed by me in the geographical work which I offer to the public.

The general map of the kingdom of New Spain is drawn up, as all the other maps drawn up by me in the course of my expedition are, according to the projection of Mercator with increasing latitudes. This projection has the advantage of showing at once the true distance of one place from another; it is at the same time the most agreeable to the navigators who visit the colonies, and who, in fixing the position

* *Rennel's Hindostan*, vol. i. p. 17.

of their vessel by two mountains seen without difficulty, would wish their survey to correspond with the map. If I had had to choose among the stereographic projections, I should have given the preference to Murdoch's, which deserves to be generally followed. The scale of my map is 32 millimetres* for every degree of the equator. The scale of increasing latitudes is not founded on the tables of Don Jorge Juan, but on those which M. de Mendoza calculated for the spheroid.

To give a more suitable form to the map of Mexico, the scale was only extended from the 15° to the 41° of north latitude, and from the 96° to the 117° of longitude. These limits did not admit of giving in the same map the intendancy of Merida or the peninsula of Yucatan, which belongs to the kingdom of New Spain. To include in the map the most eastern point, which is Cape Catoche, or rather the island Cozumel, seven additional degrees of longitude are requisite, which would have forced me to comprise in the same map a portion of the kingdom of Guatimala, for which I have no data, all Louisiana, all western Florida, a part of the Tennessée, and of the Ohio.

It is in vain to seek, in this general map of New Spain, the Spanish establishments on the north-west coast of America, establishments which are insulated, and may be considered as colonies dependent on the metropolis of Mexico. To exhibit in the same map the missions of New California would have required an additional eight degrees of longitude; for the most northern point of the kingdom is the presidio of San Francisco, situated, according to Vancouver, in 37° 48′ 30″ of north latitude, and 124° 27′ 45″ of west longitude. Hence a map of New Spain, to deserve the name of a general map,

* 125,987 In. English. *Trans.*

should embrace the immense countries included within the 89° and 125° of longitude, and within the 15° and 38° of latitude. To avoid the inconvenience of representing on a large scale countries which, in a political view, possess by no means the same interest, I wished to compress my labour within narrower bounds. I drew up, in a much smaller form, a second map, which not only exhibits in a coup d'œil all the territories which depend on the viceroyalty of Mexico, but which may also be consulted by those who wish to examine the different communications projected between the Atlantic Ocean and the South Sea. The motives which have occasioned this latter map to be extended to the port of Philadelphia, and even to the mouth of the Rio San Juan at Choco, will be explained in the sequel of this work.

Although, according to the principles often laid down by me, I persist in preferring the new measures to the old, I have not however added to my maps the scale of centesimal degrees. The Bureau of Longitudes having constantly followed, both in the *Knowledge of Times*, (Connoissance des Temps,) and in the new *Astronomical Tables* lately published, the old manner of computing the latitudes, a single individual would in vain oppose the torrent, in publishing latitudes expressed in centesimal parts. It is to be hoped, however, that the introduction of the metrical system, fixed by the arrête of the 13 Brumaire, year IX, will become gradually general. The degrees of longitude which I indicate are computed to the west of the meridian of the Imperial Observatory at Paris. If the great body of the public were not averse to even the most useful innovations, I should have preferred, to the meridian of Paris, the universal meridian proposed by one of the first geometricians of the age,* founded on the movement of the

* *Exposition du Système du Monde*, par Laplace, p. 19

great axis of the solar ellipsis. This universal meridian is 185° 30′ to the east of Paris, which is 166° 46′ 12″ of the ancient sexagesimal division. It passes, consequently, by the South Sea, 12′ to the east of the isle of Erromanga, which belongs to the archipelago of the Holy Ghost (du Saint Esprit). The introduction of a universal meridian, founded on nature itself, which would not shock the national vanity of Europeans, is so much the more to be desired, that we every day see augmented the number of first meridians arbitrarily traced on maps. Spain, for several years back, reckons five: Cadiz, the most in use with navigators; Carthagena; the new observatory at the isle of Leon; the college of Nobles at Madrid, introduced by the beautiful maps of M. Antillon; and the point de la Galera at the island of Trinidad. To these five meridians might be added other two which pass through the Spanish possessions, and have been adopted by a great number of geographers: I mean the meridian of Teneriffe and of the island of Fer. The latter occasions inevitable confusion, d'Anville placing it between the town of Fer and Cape West. So that there are seven first meridians, without reckoning Toledo, in the sole dominions of the king of Spain.

I have followed, in the denomination of the seas which wash the coasts of Mexico, the ideas proposed by M. Fleurieu in his observations on the hydrographical division of the globe; a work in which the most enlarged views are united to a profound historical erudition. The Spanish names have often been added to facilitate the reading of travels written in Spanish.

In drawing up the map of Mexico, I began by assembling together all the points fixed by astronomical observations, from which I formed a view, which, for the better appreciating the degree of confidence which the results deserve, indicates the nature of the

observation and the name of the observer. The number of these points amounts to 74, of which 50 are situated in the interior of the country. Of this latter class there were only fifteen known before my arrival at Mexico in the month of April, 1803. It may be useful to discuss some of the thirty-three points whose position is determined by my own observations, and which are all comprised between the 16° 50′ and 20° 0′ of latitude, and the 98° 29′ and 103° 12′ of longitude. While we are fixing these positions, we shall enter into some historical details respecting the extraordinary errors which have been propagated to this day in the most recent and current maps.

MEXICO.

Several meridian altitudes of the sun and stars gave me for the latitude of the capital at the convent of St. Augustin,* 9° 25′ 45″. The longitude deduced from the eclipses of the satellites of Jupiter, from the distance of the moon to the sun, from transference of the time from Acapulco, and from a trigonometrical operation for estimating the difference of meridians between Mexico and the port of Vera Cruz, is 6h 45′ 42″ or 101° 25′ 30″. I shall observe once for all, that I rely on the numbers which result from the very careful calculations of M. Oltmanns, a distinguished geometrician, who calculated all the astronomical observations made by me since my departure from Paris in 1798, to my return to Bordeaux in 1804. The longitude of Mexico

* The great gate of the cathedral church of Mexico is 12″ farther north, and 10″ farther east, than the convent of St. Augustin, near which I made my observations.

(6^h 45′ 28″) indicated in the new astronomical tables published by the *Bureau des Longitudes*, is founded on an astronomical memoir which I presented to the first class of the institute, the fourth Pluviôse, year XIII, in which the calculations of the moon had not been corrected by the tables of M. Bürg. A year before I had fixed on a result which was still nearer to the true longitude; the medium of my observations printed at the Havannah was 101° 20′ 5″.

Three emersions of the first satellite of Jupiter observed by me give for middle term, by the tables of M. Delambre, the longitude of 6^h 45′ 30″.

Thirty-two distances from the moon to the sun, calculated by M. Oltmanns, from the newest lunar tables, give for longitude 6^h 45′ 54″.

The transference of time from Acapulco gives for the difference of meridians between the port and the capital of Mexico, 2′ 54″ in time; consequently, supposing Acapulco 6^h 48′ 24″, the longitude of Mexico would be 6^h 45′ 29″.

Two observations of satellites, the one at Lancaster in Pennsylvania, the other at the Havannah, both corresponding to the emersion which I observed at Mexico, the 2d May, 1803, give in longitude, the one 6^h 45′ 33″·3″, the other 6^h 45′ 26″.

The longitude of Guanaxuato determined by lunar distances, and connected by my chronometer with that of Mexico, gives for that capital 6^h 45′ 56″.

From the trigonometrical operation, or rather from my attempt to connect the capital with the port of Vera Cruz, by means of the azimuths and angles of altitudes, taken on the volcanoes of Orizaba and Popocatepec, (according to the calculations of M. Oltmanns, and supposing Vera Cruz 6^h 33′ 55″,) there results a longitude for Mexico of 6^h 45′ 36″.

All these results, obtained by ways so various and independent of one another, confirm the longitude that we assign to the capital of Mexico, which is

more than a degree and a half different from what has been hitherto adopted; for the *Knowledge of Times* places Mexico in 1772, at 106° 1′ 0″, and again in 1804, at 102° 25′ 45″. The chart of the gulf of Mexico, published by the *Deposito Hydrografico* of Madrid in 1799, gives 103° 1′ 27″ to the capital; however, before I began to observe at Mexico, the true longitude was accurately enough known by three astronomers whose labours deserve to be better known, two of whom were born in Mexico. MM. Velasquez and Gama, so far back as 1778, had deduced from their observation of satellites the longitude of 101° 30′ but having no corresponding observations, and calculating after the old tables of Wargentin, they remained uncertain (as they themselves assured me) for more than a quarter of a degree. This curious result is contained in a small pamphlet printed at Mexico,* very little known in Europe. Velasquez, director of the supreme tribunal of mines, fixed the longitude of the capital at 101° 44′ 0″, as is proved by valuable manuscripts preserved by M. Costanzo at Vera Cruz. In a map of New Spain sketched in 1772, Velasquez gave to Mexico 278° 9′ of longitude, reckoning from the isle of Fer=101° 51′. He says in a note to this map, "that before his voyage to California in 1768, all Mexico was placed in the South Sea; that his map is the first which offers the true position of the capital, and that he verified it by a great number of observations at Santa Rosa in California, at Temascaltepec, and at Guanaxuato." M. Galeano, one of the most able astronomers of the royal marine, had also found out the true position of Mexico, when he traversed the kingdom

* Descripcion orthographica universal del eclipse de sol del dia 24 de Junio de 1778, dedicada al Sr. Don Joacquin Velasquez de Leon, por Don Antonio de Leon y Gama, 1778, p. IV.

in 1791 to join the expedition of Malaspina. It is true that M. Antillon deduced the longitude of 101° 52′ 0″ from the observations of Galeano, a result which still differs from mine 1′ 48″ in time; but I suspect that this difference arises from some trivial error which may have crept into the calculation. With the operations of Gama, Velasquez, and Galeano, I was totally unacquainted when I began my operations at Mexico. Moreover, the detail of the observations of Don Dionisio Galeano was only communicated to me by M. Espinosa during the winter of 1804, after my return to Europe. These observations give a longitude apparently much more accurate than the one published by M. Antillon. "I was ignorant, (the learned director of the *Deposito Hydrografico* of Madrid writes me,) during your residence in Spain in 1799, of the observations of our common friend M. de Galeano. They consist of two emersions of satellites and the end of a lunar eclipse: they give me 101° 22′ 34″ = 6h 45′ 30″." But M. Oltmanns found on taking the medium of the three observations, and comparing the eclipse of the moon at five different places in Europe, 6h 45′ 49″. The difference between my observations and those of the Spanish astronomer, a supposed difference of nearly half a degree, is consequently reduced to less than an arc of two minutes. It is satisfactory to find so great a harmony among observers, who, unknown to one another, employed such different methods. In the very minute maps of Thomas Jeffereys, published in 1794, Mexico is situated in 20° 2′ of latitude, and 102° 52′ 47″ of longitude; while M. Arrowsmith, in his beautiful map of the West Indies in four sheets, makes the longitude of Mexico 102° 8′ 0″, and the latitude 19° 57′, false 32 minutes.

Several Mexican geometricians of the seventeenth century guessed pretty nearly the true longitude of the capital. Father Diego Rodriguez, of the order of

N. Senora de la Merced, professor of mathematics at the imperial university of Mexico, and the astronomer Gabriel Lopez de Bonilla, adopted 7^h 25′ for the difference of meridians between Uranienburg and the capital, from whence there results the longitude of 101° 37′ 45″ = 6^h 46′ 29″. But Don Carlos de Seguenza,* the celebrated successor of Rodriguez in the academical chair, was ignorant in 1681 of the observations on which Bonilla founded this result. He published a small treatise on the longitude of the city of Mexico.† He cites in it an observation of a lunar eclipse on the 20th December, 1619, by the engineer Henry Martinez, at Huehuetoca, to the north-west of Mexico. This is the same Dutch engineer who undertook the bold enterprise of the canal called *le Desague de Huehuetoca*, of which more will be said hereafter. The observation of Martinez, comparing it with that of Ingolstadt, without applying any modification, would give 6^h 32′ 16″ for the longitude of Mexico. Compared with Lisbon, the same eclipse gives 6^h 22′ 31″. But as Martinez made use of no telescope, Seguenza supposes that by an effect of the penumbra, the end of the eclipse was 15′ sooner. There results from this very arbitrary supposition, Mexico compared with Ingolstadt, 6^h 46′ 40″, and Mexico compared with Lisbon, 6^h 37′ 31″. M. Oltmanns justly observes, that one of the corresponding observations must be 9′ false; for the true difference of meridians between Lisbon and Ingolstadt is only 1^h 22′ 16″, while the

* Libra astronomica y filosofica escrita en 1681, por Don Carlos de Seguenza y Gongora, Catedratico de Matematicas de la Universidad de Mexico, y impresso en la misma Ciudad en 1690, § 386.

† See the work above cited, § 382. 385. I owe my acquaintance with this very rare book of Seguenza to M. Oteiza, who was kind enough to recalculate several old observations of the Mexican astronomers.

eclipse of the 20th December, 1619, would give $1^h\ 13'\ 0''$. Such old and careless observations can give no certainty; particularly as the two Mexican geometricians above cited, Rodriguez and Seguenza, were not themselves in a condition to obtain these results. They knew so little of the difference of meridians between Uranienburg, Lisbon, Ingolstadt and the Isle de Palma, that they concluded from the data indicated in the *Libra Astronomica y Filosofica*, that Mexico is 283° 38′ to the west of the first meridian of the Isle de Palma, or $96^h\ 40' = 6^h\ 26'\ 40''$; a longitude which differs more than a hundred marine leagues from the true one, and more than 240 leagues from what was adopted by the geographer Jean Covens in the middle of the last century. In the Ephemerides of Vienna, published by Father Hell, in 1772, and in the astronomical tables of Berlin for the year 1776, we find Mexico at 106° 0′. The idea of this too great western longitude is very old. M. Oltmanns found it in the observations* of the jesuit Father Bonaventura Suarez, who resided at Paraguay, in the city of the holy martyrs Cosme and Damian. This astronomer places Mexico 3^h 13′† to the west of his observatory, and the latter $3^h\ 52'\ 23''$ to the west of Paris; from whence results the longitude of Mexico $7^h\ 5'\ 23'' = 106°\ 22'\ 30''$. The jesuits of Puebla also place the capital, in a Mexican map engraved in 1755, at 19° 10′ of latitude, and 113° 0′ of longitude, that is to say, 240 leagues too far west.

The account of Chappe's journey, drawn up by M. de Cassini, gives us no accurate information as to the position of the capital. Chappe even remained there only four days. He made no astronomical observations, and those which M. Alzate communica-

* Ephemerides astronomicæ, a Triesneker, 1803.

† Voyage en Californie, 1772, p. 104.

ted to him, were not of a nature to resolve the problem in question. This Mexican ecclesiastic, whom the academy of Paris named one of their correspondents, displayed more zeal than solidity in his researches: he embraced too many things at once. His acquisitions were very inferior to those of Velasquez and Gama, two of his countrymen, whose true merit has never been sufficiently known in Europe. Don Josef Antonio Alzate, and Ramirez in his map of New Spain, published at Paris, place Mexico at 104° 9′ 0″=6h 56′ 36″. M. de Lalande finds, by the transit of Venus observed in 1769 by Alzate, 6h 50′ 1″: M. Pingre finds 6h 49′ 43″. An eclipse of the moon observed in 1769, by Alzate, gives, calculating only the end by the old lunar tables, 6h 37′ 7″. Cassini deduces from two emersions of Jupiter's satellites, observed by Alzate in 1770, and compared with the *old* tables by a medium, 101° 25′=6h 45′ 9″.

In a memoir published by Alzate on the geography of New Spain,* he asserts that the longitude of Mexico, founded on observations of satellites, is 6h 46′ 30″.

But in 1786, in a note which accompanies the plan of the environs of Mexico, drawn up by Seguenza, and engraved at Mexico, Alzate fixes the longitude at 100° 30′ 0″=6h 42′ 0″, adding that this last result, *the surest of all*, is founded on more than twenty-five eclipses of satellites communicated to the academy of Paris.†

Hence there is consequently a difference of more than two degrees between the different observations of M. Alzate, without including the result deduced from the eclipse of the moon of the 12th December,

* Gazetta de Mexico, 1772, No. 95, p. 56.

† Plano de les Arcanias de Mexico por Don Carlos de Seguenza, reimpreso en 1786, con algunas adiciones de Don Josef Alzate (en la imprenta de Don Francisco Rangel.)

1769. It is to be presumed that the observer was not exact as to the time. The longitude established by the satellites may be also too eastern, because the eclipses of the first satellite have not been separated from those of the third and fourth.

The false position so long attributed to the capital of New Spain produced a remarkable effect at the time of the sun's eclipse, 21st Feb. 1803. The eclipse was total, and threw the public into consternation, because the almanacs of Mexico, calculated on the supposition of $6^h\ 49'\ 43''$ of longitude, had announced it as scarcely visible. The learned astronomer of the Havannah, Don Antonio Roberedo, recalculated this eclipse according to my observations of longitude.* He found that the eclipse would not have been total if the longitude of Mexico were farther west than $6^h\ 46'\ 35''$, $4 = 101°\ 38'\ 49''$.

The latitude of the capital of Mexico remained for a long period as problematical as its longitude. In the time of Cortez the Spanish pilots fixed it at 20° 0', as is proved by the map of California, drawn up by Domingo de Castillo in 1541, and published in the Mexican edition of Cortez's letters.† This latitude was preserved by d'Anville and other geographers. Jean Covens, who increased the longitude of Mexico seven degrees, gives it also a position too northern by 1° 43'. The account of Chappe's journey adopts from Alzate 19° 54' of latitude. Don Vincente Doz, known for his observations in California, found by a quadrant 19° 21' 2" ;‡ but in the year 1778, Velasquez and Gama fixed the true position. Don Jose Espinosa found in February, 1790, by a sextant of eight inches radius, the cathedral 19° 25' 25" of lati-

* Aurora, or Correo politico economico de la Havana, 1804, No. 219. p. 13.

† Historia de Nueva Espana escrita por Herman Cortes, aumentada por el Illustr. Senor Don Francisco Antonio de Lorenzana. Mexico, 1770, p. 328.

‡ Gazetta de Mexico, 1772, p. 56.

tude. M. Galeano obtained in 1791, by larger instruments, 19° 26′ 00″.

VERA CRUZ.

Latitude, 19° 11′ 52′. Longitude, 6h 33′ 56″ = 98° 29′ 0″. This longitude is deduced from a stellar eclipse, observed by M. Ferrer, and calculated by M. Oltmanns, from three eclipses of the first satellite, and from the longitude which my observations assign to the Havannah, and which has been connected by the transference of time to Vera Cruz. It is to be observed, that I indicate the position of the most northern part of the city, the observatory of M. Ferrer being the house of Don Jose Ignacio de la Torre, which is 30″ to the west of the fort of St. Juan d'Ulua.

This longitude is almost the same with what was found by Don Mariana Isasvirivil, and by other officers of the Spanish marine. It is only five minutes *en arc* farther west than what is indicated on the map of the gulf of Mexico, published in 1799 by the hydrographical board of Madrid. M. Antillon fixes it at 98° 23′ 5″; the *Knowledge of Times* for the year 1808, at 98° 21′ 45″. Don Thomas Ugarte, commodore (Chef d'Escadre) in the service of the king of Spain, connected by the transference of time Vera Cruz with Porto Rico. He assigns to the first port 98° 39′ 45″. M. Ferrer deduced in 1791 and 1792 the longitude of Vera Cruz from sixty series of distances from the moon to the sun and stars: he obtained as a middle term, 98° 18′ 15″. But it would be exceedingly interesting to publish a detail of these observations, that they might be recalculated according to the tables of Bürg. The same observation applies to the results published in Vancouver's voyage.

The city of Vera Cruz has shared the same fate with Mexico and the whole of the new continent. They have been believed 60, nay even 140 leagues farther distant from Europe than they are in reality. Jean Covens placed Vera Cruz at 104° 45′ 0″; Alzate, in his map of New Spain, at 101° 30′. M. Bonne* justly complains of the want of agreement among the astronomical observations at Vera Cruz. After a long discussion he fixes on 99° 37′. This is nearly the same longitude which d'Anville and the French Neptune adopted, and it is that to which the English astronomers have long given the preference. The tables of Hamilton Moore indicate 99° 49′ 47″; but Arrowsmith (map of the Spanish possessions, 1803) makes it 98° 40′, and nine years before, Mr. Thomas Jeffreys, geographer to the king of England, 100° 23′ 47″.

If formerly the prevailing error was the assigning too great western longitudes to the American ports, the Abbé Chappe fell into the contrary extreme: he deduced from his chronometer the longitude 97° 18′ 15″†. If this observer, who possessed more zeal than accuracy, could have taken the distances from the moon to the sun, he would have perceived the error of more than a degree, into which he had been induced by an excess of confidence in his chronometer.

The oldest astronomical observation at Vera Cruz (at the chateau St. Juan de Ulua) is undoubtedly that of the moon's eclipse in 1577. Comparing the end of that eclipse with a corresponding observation at Madrid, M. Oltmanns found a difference of meridians of 6h 26′, and consequently the longitude for Vera Cruz of 102° 30′.‡

* Atlas pour l'ouvrage de l'Abbé Raynal, p. 11.

† Voyage en Californie, p. 102.

‡ Mémoires de l'Academie pour l'année 1726.

The Abbé Chappe found the latitude 19° 9′ 38″,* a position too southern by three minutes. I examined the small quadrant of Chappe which remains at Mexico, in the hands of Father Pichardo; and I am by no means astonished, that, with so imperfect an instrument, his observations were so inaccurate. Other geographers formerly placed Vera Cruz 20′ too far to the south. The map of New Spain of Alzate indicates even a latitude of 18° 50 0″.

ACAPULCO.

This port, the finest of all those on the coast of the great ocean, lies according to my observations (at the house of the contador Don Baltasar Alvarez Ordono) in 16° 50′ 29″ of latitude, and 6h 48′ 24″ =102 6′ 0″ of longitude. This position was deduced by M. Oltmanns from twenty-eight distances taken by me from the moon to the sun. Those of the 27th March, 1803, calculated according to the tables of Bürg, gave 6h 48′ 32″; and those of the 28th March 6h 48′ 21″.

The difference of meridians between Mexico and Acapulco is, according to my chronometer, 2′ 54″ of time. Now, Mexico having been found by the medium of my lunar distances 6h 45′ 42″ of longitude, there would result for Acapulco, excluding every other species of observation, 6h 48′ 48″. An uncertainty of 19″ of time is very trifling for the comparison of two longitudes, deduced from simple distances from the moon to the sun. I found Acapulco in 1803, by the lunar tables of Mason, 102° 8′ 9″.

* Voyage en Californie, p. 103.

This position differs very little from what is indicated by the atlas which accompanies the voyage of the Spanish navigators to the Straits of Fuca, and which is 102° 0′ 30″ of longitude, and 16° 50′ 0″ of latitude. This atlas is founded on the operations of the expedition of Malaspina. However M. Antillon, in an excellent memoir above cited, gives a result, deduced from the same operations, which differs more than *a third of a degree*. He asserts, that the observations in 1791, by the astronomers who embarked in the corvettes la *Descuberta* and la *Atrevida*, fixed Acapulco at 102° 21′ 0″ of longitude; a result which appears to me less exact, though more conformable to the manuscripts left by these navigators in Mexico. They themselves deduced, from eight series of lunar distances, 102° 26′; from an immersion of the first satellite, 102° 20′ 40″; and from the transport of time* from Guajaquil, 102° 22′ 0″; an admirable, but perhaps merely apparent, harmony, on account of the errors of the old lunar tables. Besides, the longitude, deduced in 1794 from the operations on board the brigantine Activo, was equally western. This expedition examined the coasts of Sonzonate and Soconusco, and fixed the longitude of Acapulco at 102° 25′ 30″; though I am completely ignorant of the nature of the observations on which this longitude is founded.

A note in the manuscript-writing of one of the astronomers of the expedition of Malaspina, left at Mexico, bears, that they thought themselves warranted to de-

* This chronometrical longitude of 102° 22′ is also found in the minute plan of the port of Acapulco, drawn up by the expedition of Malaspina, and copied at the audience of the pilotage of Lima. It appears, in fact, that the astronomers of this expedition had at first adopted much more western positions than those afterwards adopted by the Deposito Hydrografico of Madrid. The difference for Acapulco is 20′, for Guayaquil 16′, for Panama and Realexo 18′, *en arc*.

duce, from some eclipses of satellites observed, at the same time, at the capital and Acapulco, a difference of meridians of 2′ 21″ in time. In placing, with the new maps of the *Deposito Hydrografico*, Acapulco at 102° 0′, we should find Mexico 101° 24′ 45″, which is, to within about 700 toises, the longitude given by the medium of all my operations. I should doubt, however, of the accuracy with which the distance from the capital to Acapulco was deduced. It is probably greater than 2′ 21″, though perhaps also somewhat less than the 2′ 54″ given by my chronometer, worn out with five years travelling, and passing rapidly in so mountainous a region from the extreme heats of the coasts, to the frosts of Guchilaque; that is to say, from a temperature of 36° to another of 5° of the centigrade thermometer.

Formerly Acapulco was placed four degrees further to the west in the South Sea. Jean Covens and Corneille Mortier, in their map of the Mexican archipelago, make the longitude of Acapulco 106° 10′ 0″. The old maps of the depot of the marine make it 104° 0′. This longitude became gradually more eastern. Bonne, in the geographical memoir annexed to the work of Raynal, gives 103° 0′: Arrowsmith, in 1803, makes it 102° 44′.

The *Knowledge of the Times* (Connoissance des Temps) for the year 1808, fixes Acapulco very well in point of longitude, (102° 19′ 30″,) but assigns it a latitude too southern by 10′. This error is so much the more striking, as, before the expedition of Malaspina, this port was placed at 17° 20′, or 17° 30′, as is proved by the maps of d'Anville and those of the marine depot. However, Covens makes the latitude 16° 7′, while in 1540 the pilot Domingo de Castillo gives it at 17° 25′. In the time of Herman Cortez, the capital of Mexico was believed to be three degrees to the west of Acapulco, almost north to south

with the port de los Angeles. Probably the maps which the Mexicans themselves had constructed of their coasts, and which the emperor Montezuma presented to the Spaniards, had an influence on this position. I have myself remarked among the hieroglyphic manuscripts in the collection of Boturini, preserved in the palace of the viceroy of Mexico, a very curious plan of the environs of the capital. I should add, that long before the observations of the expedition of Malaspina at Acapulco, those who were employed in astronomy at Mexico admitted, as certain, that the capital and port were in the same meridian.

JOURNEY FROM MEXICO TO ACAPULCO.

Having fixed the position of the three principal places of the kingdom, let us examine the two roads which lead from the capital to the South Sea, and to the Atlantic Ocean. The first may be named the Asiatic road, and the other the European; as these denominations designate the direction of the maritime commerce of New Spain. I determined, on these highly frequented roads, seventeen points either in latitude or longitude.

Village of *Mescala*.—I found its latitude, by the culmination of Antares, 17° 56′ 4″, and the longitude, by the chronometer, 6^h 47′ 16″, supposing Acapulco 6^h 48′ 24″. The city of Chilpanzingo, from angles taken at Mescala, appears to be 17° 56′ of latitude, and 6^h 46′ 53″ of longitude.

Venta de *Estola*, a solitary house in the midst of a wood near a fine spring. I took several altitudes of the sun there: the chronometer gave 6^h 46′ 56″ of longitude.

The village of *Tepecuacuilco*.—Latitude found by the method of Douwes, uncertain to the extent of nearly 3′, 18° 20′ 0″.

Village of *Tehuilotepec.*—Longitude, 6h 47′ 12″ Double altitudes of the sun gave me 18° 35′ 0′; but this latitude, determined under unfavourable circumstances, is uncertain from six to seven minutes. The position of this place is interesting, on account of the proximity of the great mines of Tasco.

Pont d'*Istla*, in the great plains of S. Gabriel. I found it 18° 37′ 41″ of latitude, and 6h 46′ 19″ of longitude.

Village of *San Augustin de las Cuesas.*—Longitude, 6h 45′ 46″. Latitude, 19° 18′ 37″. This village terminates on the west the great valley of Mexico.

It will be useful, for a minute acquaintance with the country, to add the distances which the natives, particularly the muleteers, who travel as it were in caravans to the great fair of Acapulco, reckon from one village to another. The true distance from the capital to the port being known, and supposing a third more for windings in a road both straight and of easy access, we shall find the value of the leagues in use in these countries. This datum is interesting for geographers, who in remote regions must avail themselves of simple itineraries. It is evident that the people shorten the leagues as the road becomes more difficult. However, under equal circumstances we may have some confidence in the judgments formed by the muleteers of comparative distances; they may not know whether their beasts of burden go two or three thousand metres* in the space of an hour, but they learn from long habit if one distance be the third or fourth or the double of another.

The Mexican muleteers estimate the road from Acapulco to Mexico at 110 leagues. They reckon from Acapulco to the Passo d'Aguacatillo, four leagues; el Limon, three leagues; los dos Aroyos,

* 6561 or 9842 feet English. *Trans.*

five; Alto de Camaron, four; la Guarita de los dos Caminos, three; la Moxonera, one-half; Quaxiniquilapa, two and a half; Acaguisotla, four; Masatlan four; *Chipansingo*, four; *Sampango*, three; Sapilote, four; Venta Vieja, four; *Mescala*, four; Estola, five; Palula, one and a half; la tranca del Conexo, one and a half; Cuagolotal, one; Tuspa, or Pueblo nuevo, four; los Amates, three; Tepetlalapa, five; Puente de *Istla*, four; Alpuyeco, six; Xuchitepeque, two; *Cuernavaca*, two; S. Maria, three-fourths; *Guchilaque*, two and a half; Sacapisca, two; la Cruz del Marques, two; el Guarda, two; Axusco, two; San *Augustin de las Cuevas*, three; *Mexico*, four. In this itinerary the numbers indicate how many leagues one place is distant from the one which immediately precedes it. Other itineraries, which are distributed to travellers who come by the South Sea, estimate the total distance at 104 or 106 leagues. Now, according to my observations it is in a straight line 151,766 toises. Adding a quarter for windings, we shall have 189,708 toises, or 1,725 toises* for the league of the country.

JOURNEY FROM MEXICO TO VERA CRUZ.

I determined on this road thirteen points, either by purely astronomical means, or by geodæsical operations, particularly by azimuths and angles of altitudes. M. Oltmanns deduced from my observations the position of the Venta de Chalco, on the eastern bank of the great valley of Tenochtitlan, 19° 16′ 8′; that of la Puebla de los Angeles (near the cathedral) 19° 0′ 15″ of latitude, and 6^h 41′ 31″ = 100° 22′ 45″ of longitude; of the Venta de Sotto, 19° 26′ 30″; of the village of Perote, near the fortress of the same name, 19° 33′ 37″

† 11,049 feet. *Trans.*

of latitude, and 6^h 38′ 15″ of longitude; of the village de las Vigas, 19° 37′ 10″; and finally, the position of the city of Xalapa, 19° 30′ 8″ of latitude, and 6^h 37′ 0″ = 99° 15′ 0″ of longitude. Don Jose Joaquin Ferrer, who, long before me, determined several points in the environs of Vera Cruz and Xalappa, found for the last city 19° 31′ 10″ of latitude, and 99° 15′ 5″ of longitude. Both of us observed near the convent of St. Francis. In this fertile and cultivated region, four mountains, three of which are perpetually covered with snow, deserve the greatest attention. A knowledge of their exact position serves to connect several interesting points. The two volcanoes distinguished by the names of Puebla or Mexico (Popocatepetl and Iztaccihuatl) have been connected with the capital and the pyramid of Cholula. I found the latitude of Popocatepetl 18° 59′ 47″, and 6^h 43′ 33″ = 100° 53′ 15″ of longitude; the latitude of Sierra Nevada, or Iztaccihuatl, 19° 10′ 0″, and 6^h 43′ 40″ = 100° 55′ 0″ of longitude. M. Costanzo deduced from a series of geodæsical operations, 19° 11′ 43″ for the latitude of Iztaccihuatl, and 19° 1′ 54″ for that of Popocatepetl. The operations of this engineer having been made by means of a compass, and the magnetic declension depending on a great number of small local causes, we ought to be astonished at the accuracy of the results which have been obtained. These two colossal mountains, as well as the Pic d'Orizaba, being visible from the level of the pyramid of Cholula, I endeavoured very carefully to determine the position of this ancient monument. I found the latitude of the chapel which crowns the extremity of the pyramid, 19° 2′ 6″, and 6^h 42′ 14″ = 100° 33′ 30″ of longitude.

M. Ferrer deduced the position of the Cofre de Perote from the geodæsical operations between l'Encero and Xalappa, and found 19° 29′ 14″. I was able, in spite of the rigour of the season, to carry in-

struments on the seventh of February, 1804, to the top of this mountain, which is 384 metres* higher than the Peak of Teneriffe. I observed there the meridian altitude of the sun, which gave for l'Alto de los Caxones (43″ *en arc* farther north than the summit or Pena del Cofre) 19° 29′ 40″ of latitude. The longitude was found by M. Oltmanns, who employed the angles taken by me between the Cofre and the Pic d'Orizaba, 6ʰ 37′ 55″, which differs but 26′ in time from that fixed by M. Ferrer.

The exact knowledge of the position of the Pic d'Orizaba is of great importance for navigators on landing at Vera Cruz. The chart of the gulf of Mexico, published in 1799, by the Deposito Hydrografico at Madrid, places this mountain a degree too far to the east, at 100° 29′ 45″ of longitude. *Angles of altitudes and azimuths taken by me, gave M. Oltmanns* 19° 2′ 17″ *of latitude, and* 99° 35′ 15″=6ʰ 38′ 21″ *of longitude.* But long before me the Spanish mariners knew the true position of the Pic d'Orizaba. It would appear that the error of the map of the *Seno Mexicano*, which passed in the French map,† should be attributed to some accidental mistake on the part of the engraver. It is corrected in the edition of M. Bausa in 1803. The name of the capital of Mexico is effaced in it, and the Pic d'Orizaba is placed at 99° 47′ 30″ of longitude. M. Ferrer fixes the mountain, as is proved by manuscripts in my possession, drawn up in 1793, at 19° 2′ 1″ of latitude and 99° 35′ 35″ of longitude. The same result was also obtained by M. Isasvirivil, whose great accuracy I had occasion to know, having observed along with him at Lima and Callao in 1802.

It appears astonishing that the most recent map

* 1,260 feet. *Trans.*

† Carte des côtes du golfe du Mexique, d'après les observations des Espagnols, An. 9.

which we possess of that part of New Spain which we are analysing, and which bears the name of a justly esteemed author, should be the falsest of all. I speak of the large English map, which has for title, *Chart of the West Indies and Spanish Dominions in North America, by Arrowsmith*, published in June, 1803. From Mexico to Vera Cruz the names appear to be scattered at random. The position of the Pic d'Orizaba is indicated in it in a manner which might prove dangerous to navigators. The following table gives the position of the principal points, such as this map, very beautiful in other respects, indicates them. I have added the result of my astronomical observations. The longitudes are reckoned to the east of Vera Cruz, to avoid introducing into this comparison the absolute position of this port.

CHART OF ARROWSMITH.			RESULTS OF ASTRONOMICAL OBSERVATIONS.		
	Latitude.	Longitude.		Latitude.	Longitude.
Mexico -	19° 57′	3° 38′	Mexico -	19° 25′ 45″	2° 56′ 30″
Volcano of Mexico	19° 33′	3° 0′	Popocatepec -	18° 59′ 47″	2° 24′ 15″
Puebla -	19° 33′	2° 25′	Puebla -	19° 0′ 15″	1° 53′ 45″
Mount Orizaba -	20° 3′	1° 50′	Pic d'Orizaba -	19° 2′ 17″	1° 6′ 15″
Volcano of Tlascala	19° 33′	1° 54′			
Perotte -	19° 48′	1° 37′	Perotte -	19° 33′ 37″	0° 59′ 45″
False Orizaba -	19° 51′	1° 12′			
Xalappa - -	19° 36′	1° 0′	Xalappa -	19° 30′ 8″	0° 46′ 0″
Cordoba -	19° 15′	1° 6′	Cordoba -		

The errors of latitude are consequently of more than *half a degree*. It is difficult to conceive what is meant to be designed in the map of Arrowsmith by the three mountains named Orizaba, False Orizaba, and Volcano of Tlascala. They are all indicated to the *north-west* of the port of Vera Cruz, while the true Pic d'Orizaba (and the Mexicans know but one, called in the Azteque language Citlaltepetl) lies to the *south-west* of Vera Cruz, between the city of Cordoba and the villages of San Andres, San Antonio, Huatusco, and St. Jean Coscomatepec. There is added to the False Orizaba the note "visible to the eye at 45 leagues distance." Now Citlaltepetl is the summit which navigators first see in approaching the coast of New Spain; consequently it might be inferred that the learned English geographer named it *False Orizaba*. But in this case, the latitude of this problematical mountain would be a degree false, and Orizaba would be seven marine leagues to the north of the city of Xalappa, while in reality it is only twelve to the south-south-west. Or should the Pic d'Orizaba of Arrowsmith be the Cofre de Perotte? But the Cofre lies also to the south-east, and not to the south-west of the village of Perotte. This fable of two mountains of the name of Orizaba is to be found also in the atlas of Thomas Jeffereys, (*The West-Indian Atlas, London*, 1794,) where an attempt is made to convey minute information as to the road from Vera Cruz to Mexico. The latitudes are there 36′ false. The difference of longitude between the port and the capital is marked 2° 29′ instead of 3° 38′ as in the map of Arrowsmith, and instead of 2° 56′ 30″ the result of my astronomical observations. It is also very improbable that the Volcano of Tlascala, indicated in this new English map, is the Sierra de Tlascala, called in the country Malinche; for this Sierra is neither very remarkable for its elevation, nor very

distant from la Puebla. This confusion is so much the more astonishing, as in 1803, the excellent observations of Don Jose Joacquin Ferrer, published in 1798, were known in London*, as well as the maps drawn up by the *Deposito Hydrografico* of Madrid; though even M. Antillon places it in 1802, in his map of North America, la Peubla 32′ too much to the south.

POINTS SITUATED BETWEEN MEXICO, GUANAXUATO, AND VALLADOLID.

In two excursions which I made, the one to the mines of Moran and to the porphyretical summits (organos) of Actopan, the other to Guanaxuato and to the volcano of Jorullo in the kingdom of Mechoacan, I determined the position of ten points, whose longitudes are almost all founded on the transference of time. These points have enabled me to give with some accuracy, a great part of the three intendancies of Mexico, Guanaxuato, and Valladolid. The longitude of the city of *Guanaxuato* was verified by distances from the moon to the sun. Its latitude, deduced from the observation of de la Grue, is 21° 0′ 9″. Fomachant gave me 21° 0′ 28″, and de la Grue, 21° 0′ 8″. The Jesuits in their

* Ephémérides géographiques de M. de Zach, 1798, T. II. p. 393. It is from this map that I cite the results obtained by M. Ferrer. They sometimes differ from those indicated in the manuscripts, which that excellent and indefatigable observer had, probably from less careful calculations, drawn up upon the spot, of which I am in possession of copies. I am bound to make this observation for the sake of those, who, having procured copies of my works, may be astonished at finding numbers in them differing from those now published by me. It is only after calculating carefully every observation that we can arrive at exact results.

map, engraved at la Puebla in 1755, placed Guanaxuato at 22° 50′ of latitude, and 112° 30′ of longitude, an error of 9° ! M. Velasquez, who observed the satellites of Jupiter at Guanaxuato, found this city 1° 48′ to the east of Mexico, but at 20° 45′ 0″ of latitude, as is proved by his manuscript map of New Spain. This error of latitude is so much the more extraordinary, as the difference in longitude which it indicates is to within an arc of 1′, the same with what results from my observations.

Latitude of *Toluca* by de la Grue 19° 16′ 24″, by Fomachant, 19° 16′ 3″. I endeavoured as much as possible constantly to observe the same stars to diminish any error from the uncertainty of the declination.

The position of Nevado de Toluca, the latitude of Patequero, a city situated on the banks of the lake of the same name, of Salamanca, St. Juan del Rio, and Tisayuca, are founded on imperfect observations. There are circumstances in which the method of Douwes gives very inaccurate results; but in a country presenting so few fixed points we must often be contented with a simple approximation. I think I can venture to assert, that the longitudes of Queretaro, Salamanca, and San Juan del Rio, may be confidently relied on.

Even in the valley of Mexico there are several very important points, the position of which was determined by Velasquez, the celebrated Mexican geometrican of the eighteenth century. This indefatigable man executed in 1773 an extensive survey along with a trigonometrical operation, to prove that the waters of the lake of Tezcuco might be conducted to the canal of Huehuetoca. M. Oteiza was kind enough to calculate for me the triangles of Velasquez, of which I possess the manuscripts. M. Oltmanns went over the same calculations. He subjected the positions of the signals to the latitude and longitude

which we have here adopted for the convent of St. Augustin in the capital of Mexico. These results of M. Oltmanns are contained in the table of geographical positions. No doubt can remain as to the oblique distances; but the want of observations of azimuths gives a little uncertainty to the reduction of the perpendiculars or differences in latitude and longitude. We shall return to this subject in the analysis of the map of the environs of Mexico.

The seventeen positions fixed by M. Ferrer in the environs of Vera Cruz depend on the longitude of that port. That longitude having been supposed by me 10° 45′ farther west than the Spanish astronomer indicates, I have reduced to the meridian of Paris the longitudes published by M. Ferrer adding 8° 47′ 15″; for that observer calculated the lunar distances, from the *Knowledge of Times*, at an epoqua when Cadiz was believed to lie 8° 36′ 30″ to the west of Paris. I have for the same reason changed the absolute longitudes of Xalappa, the Cofre de Perotte, and the Pic d'Orizaba. M. Ferrer, for instance, places the latter at 90° 48′ 23″ of west longitude from Cadiz, while from the same meridian he fixes Vera Cruz at 98° 41′ 45″.

OLD AND NEW CALIFORNIA.

PROVINCIAS INTERNAS.

The north-west part of New Spain, the coast of California, and of what the English call New Albion, contain many points determined by the most exact geodæsical and astronomical operations of Quadra, Galeano, and Vancouver. Few European charts are better established than those of Western America, from Cape Mendocino to Queen Charlotte's Straits.

Cortez, after setting on foot two voyages of discovery in 1532, under Diego Hurtado de Mendoza,

Diego Becerra, and Hernando de Griscalva, examined himself in 1533 the coast of California, and the gulf which has since very justly borne the name of the sea of Cortez.* In 1542 the intrepid Juan Rodriguez Cobrillo pushed as far north as 44° of latitude; the Sandwich Islands were discovered by Juan Gaëtan; and in 1582 Francisco Gali discovered the north-west coast of America under 57° 30′ of latitude; so that long before the intrepid Cook made this part of the great ocean to be known, which cost him his life, the same regions had been visited by Spanish navigators. But very often the rapid promulgation of discoveries does not depend upon him who makes them. Yet the merit of a private citizen is independent of the false policy of a government, which from an ignorance of its own interest would prevent a nation from enjoying the glory which it has earned. But this subject, equally delicate and interesting, has been treated with great discernment, in the historical introduction to the voyage of Marchand, and in the introduction to the account of the Spanish expeditions undertaken for the discovery of the Straits of Fuca.

The observation of the transit of Venus in 1769, occasioned the voyage of MM. Chappe, Doz, and Velasquez, three astronomers, of whom the first was a Frenchman, the second a Spaniard, and the third a Mexican, and, what is more, the pupil of a very intelligent Indian in the village of Xaltocan. Before, however, the arrival of these astronomers in California, the true latitudes of Cape San Lucas and the mission of St. Rose had already been found by Don Miguel Costanzo, at present general of brigade and head of the corps of engineers. This respectable officer, who displays the greatest zeal for the geography of the country, found by gnomons and English octants of a

* Gomara *Hist.* cap. 12.

very perfect construction, San Jose to be 23° 2′ 0″; and Cape San Lucas, 22° 48′ 10″. Till then it was believed, as is proved by the chart of Alzate, that San Jose lay in 22° 0′ of latitude.

The detail of the observations of the Abbé Chappe does not inspire much confidence. Provided with a large quadrant of three feet radius, Chappe found the latitude of San Jose by Arcturus 23° 4′ 1″; by Antares, 23° 3′ 12″. The medium of all the stellar observations differs from the result of the passages of the sun through the meridian by 31″. There are some of the solar observations which differ from one another 1′ 19″. M. Cassini, however, calls them "very exact and very accordant."* I cite these examples, not for the sake of discrediting astronomers who have so many titles to our esteem, but to prove that a sextant of five inches radius would have been more useful to the Abbé Chappe than his quadrant of three feet radius, difficult both to place and to verify. Don Vicente Doz placed San Jose at 23° 5′ 15″ latitude. The longitude of this celebrated village in the annals of astronomy was deduced from the transit of Venus, and from the eclipses of Jupiter's satellites, observed by Chappe, and compared with the tables of Wargentin. M. Cassini fixed it by a medium at 7ʰ 28′ 10″, or 112° 2′ 30″. Father Hell adopted 7ʰ 37′ 57″ for San Jose. The longitude which results from Chappe's observations is 3° 12′ farther east than the one adopted in 1768 in the map of Alzate.† M. Velasquez too, the Mexican astronomer, constructed a small observatory in the village of St. Anne, where he observed by himself the transit of Venus, communicating the result of his observation to M.

* Voyage en Californie, p. 106.

† Nouvelle Carte de l'Amérique Septentrionale, dediée à l'Académie Royale des Sciences de Paris par Don Joseph Antoine de Alzate et Ramiret, 1768.

Chappe and Don Vicente Doz. This result, published by M. de Cassini, agrees very well with the manuscript observations which I procured at Mexico, and might serve to determine the longitude of St. Anna. Moreover, M. Velasquez, before the arrival of the Abbé Chappe, knew the enormous error in the longitude of California; he had observed eclipses of Jupiter's satellites in 1768, at the mission of Santa Rosa;* and he communicated to the European astronomers the true longitude before they had time to make the slightest observations.

The position of Cape San Lucas, called in Cortez's time Santa de San Jago† has been determined by the Spanish navigators. I found in manuscripts preserved in the archives of the viceroyalty of Mexico, and compiled by order of the Chevalier d'Aranza, that M. Quadra found Cape St. Luca

* Estado de la Geografia de la Nueva Espana y modo de perfeccionar la por Don Jose Antonio de Alzate (Periodico de Mexico, Diciembre 1772, No. 7. p. 55.)

† Mapa de California por Domingo de Castillo, 1541.

‡ M. Aranza, viceroy of Mexico, employed M. Casasola *licutenant de frégate* of the royal marine, to unite in four manuscripts whatever was connected with the navigations performed to the north of California, under the viceroys Bucarelli, Florez, and Revillagigedo. These works consist, 1st, in an atlas of twenty-six maps drawn up from the observations of MM. Perez, Canisarez, Galeano, Anadra, and Malaspina; 2d, in a large folio volume, entitled, *Compendio historico de las Navegaciones sobre las costas septentrionales de California ordenado en* 1799 *en la ciudad de Mexico*; 3d, the voyage to the north-west coast of America, performed by Don Juan Francisco de la Bodega y Quadra, commanding the frigates Sta. Gertrudis, Aranzasa, Princesa, and the *goëllette* Activa, 1792; and, 4th, in a *Riconociemiento de los quatros Establecimientos Russos al Norte de la California* 1788, a curious expedition executed by order of the viceroy Florez, and described by Don Antonio Bonilla. Part of these valuable materials has been given to the public in the *Relacion del Viage de las Galetas Sutil y Mexicana*, published Madrid in 1802.

22° 52′ of latitude, and 4° 40′ to the west of the port of S. Blas, which, in placing S. Blas with Malaspina in 107° 41′ 30″, gives 112° 21′ 30″ for the most southern cape of California. The expedition of Malaspina fixed (according to M. Antillon) Cape S. Lucas at 22° 52′ of latitude, and 112° 16′ 47″ of longitude. This chronometrical position was also adopted in the atlas which accompanies the voyage of the Spaniards to the Straits of Fuca; it is, however, 17′ 15″ more western than that published (on what authority I know not) in the *Knowledge of Times* for 1808. I have adopted a difference of meridian between San Jose and the Cape of 14′ 17″; but it is to be observed, that these two points having never been connected together, but fixed singly by independent observations, there may be an error in the distance. From what I have gathered from those who have visited these arid desert regions, it would appear that the difference of longitude is somewhat greater. In the time of Cortez, Cape S. Lucas was believed to be 22° of latitude, and 10° 50′ to the west of the meridian of Acapulco, a relative longitude which is correct to within nearly half a degree.

The coast of New California has been explored with the greatest minuteness by the Spanish expedition of the galleys *Sutil* and *Mexicana* in 1792, and the country from 30° of latitude, or from the mission of S. Domingo, by the expedition of Vancouver. Malaspina and the unfortunate La Peyrouse had also made observations at Monterey. Though it may be supposed that the direction of the coasts and the differences of longitudes of several points are perfectly determined, it is difficult to fix their *absolute longitudes*; for the observations of lunar distances by Vancouver place the north-west coast of America 28′ to the east of the position in longitude assigned to it by Cook and Malaspina's expedition.* It would

* *Voyage de Vancouver autour du monde*, T. II. p. 46.

be very curious to examine the influence of the new lunar tables of Bürg on these observations of the English navigator. I have given the preference to the absolute longitude of Monterey, deduced from the operations of Malaspina, not only because it is founded on eclipses of stars and satellites, but particularly because the Spanish observations connect as it were, by transference of the time, New California with the old. The corvettes la Discubrerta and l'Atrevida, commanded by Don Alexandro Malaspina, determined chronometrically the difference of longitude between Acapulco, S. Blas, Cape S. Lucas, and Monterey. In adopting the more eastern position of the latter port, that is to say, what is given by Vancouver, the geographer is uncertain as to the situation of the southern coast. To avoid this difficulty, I have followed Malaspina in placing Monterey at 36° 35′ 45″ of latitude, and 124° 23′ 45″ of longitude.* La Peyrouse† found the longitude by lunar distances 123° 34′ 0″, by the chronometer 124° 3′ 0″.‡ Vancouver deduced a longitude of 123° 54′ 30″ from 1,200 distances of the moon from the sun. As the latter had leisure to survey the situation of the coast with the most scrupulous accuracy, I have ventured to rely on the difference of longitude indicated by him between Monterey and the missions of S. Diego, S. Juan, S. Buenaventura, S. Barbara, and S. Francisco. In this manner the positions of all these points have been connected with that of Monterey. Had I, however, traced all the north-west coast from the sole observations of Vancouver, I should have been tempted to render the longitude of Cape S. Lucas more eastern. It is sufficient to have

* Analysis de la Carta de Antillon, 1803, p. 50.

† Voyage, T. III. p. 304.

‡ M. Triesnecker, in correcting the result obtained by La Peyrouse, found by means of the lunar observations of Greenwich the longitude 123° 42′ 12″ in place of 123° 34′ 0″ (*Zach Corr.* T. I. p. 173.)

here indicated the striking difference which yet subsists, notwithstanding the great pains bestowed, between the English and Spanish operations. I have reason to believe that the absolute positions laid down by us for Acapulco, S. Blas, and Cape Lucas, are sufficiently correct, and that the error of + 28′ *or more* exists farther to the north. A false supposition in the diurnal course of a chronometer, and the state of the old lunar tables of Mayer and Mason, may have contributed to this error.

After discussing the positions which are founded on astronomical observations by experienced observers, I pass to those which may be regarded as doubtful, on account of the imperfection of the instruments, the want of confidence which the names of the observers inspire, and of our ignorance whether the results have not been drawn from manuscripts inaccurately copied. What follows is the substance of what I have been able to collect from these astronomical observations: they must be employed with caution; but they are valuable for the geography of a region hitherto so little known.

The Jesuits are entitled to the praise of having been the first who examined the gulf of California or the sea of Cortez. Father Kin, formerly professor of mathematics at Ingolstadt, and the declared enemy of the Mexican geometrician Siguenza, against whom he composed several writings, arrived in 1701 at the junction of the great rivers Gila and Colorado. He fixed by an astronomical ring the latitude of this junction at 35° 50′. I see from a manuscript map drawn up in 1541 by Domingo de Castillo, found in the archives of the family of Cortez, that at this epoqua two rivers were already known, which appeared to unite under the latitude of 33° 40′, and were called Rio de Buena, Guia, and Brazo de Miraflores. Three years before, in 1538, Father Pedro Nadal found by the meridian altitude of the sun, the junction of the Gila and Colorado, 35° 0′.

Fray Marcos de Niza made it 34° 30′. It was undoubtedly on these grounds that Delisle adopted 34° in his maps: but in a work printed at Mexico,* recent observations are cited, made by means of an astronomical ring by two well instructed fathers of St. Francis, Fray Juan Diaz, and Fray Pedro Font; observations which agree with one another, and which would seem to prove that the junctions are much more southern than has hitherto been believed. In 1774, Father Diaz obtained at the mouth of the Gila, two days successively, 32° 44′. Father Font found there, in 1775, 32° 47′. The former asserts also, that from a simple consideration of the road followed by him, that is to say, a consideration of the rhombs and distances, it is impossible that the junctions can be at 35° of latitude. The positions which Father Font assigned in 1777 to the missions of Monterey, S. Diego, and S. Francisco, and which differ but a few minutes from the result of Vancouver and Malaspina's observations, would seem to testify in favour of the accuracy of his labours, provided these fathers did not copy the data furnished to them by their pilots. Besides, it is certain that a zealous observer may, with very imperfect means, procure often very satisfactory results. The latitudes obtained by Bouger in the Rio de la Magdalena, with a gnomon from seven to eight feet in height, and employing for a scale pieces of reeds, differ only from four to five minutes from what I found fifty-nine years afterwards by means of excellent English sextants.

However, Father Font appears to have been less fortunate with his astronomical ring in fixing the latitude of the mission of S. Gabriel at 32° 37′, that of S. Antonio de los Robles at 36° 2′, and that of Luis Obispo at 35° 17′. Comparing these positions with the atlas of Vancouver, I find that the errors are sometimes +1° 11′, sometimes — 23′. It is

* *Cronica Serafica de Queretaro*, p. 11. 1792, *Prologo*.

true, the English navigator did not himself visit these three missions, but he connected them with the neighbouring coast, the situation of which he examined. From hence may be seen how much we ought to be on our guard against observations made with astronomical rings. Fray Pedro Font visited also the site of the ruins called *las Casas grandes;* and he found them 33° 30′. This position, were it exact, would be very important; for it is the site of an ancient cultivation of the human species. We must not, however, confound this second abode of the Azteques from which they passed from Tarahumara to Colhuacan,* with the Casas grandes, or the third abode of the Azteques, situated to the south of the presidio of Yanos, in the intendancy of New Biscay. I could wish to know the observations of the jesuit Father Juan Hugarte, who discovered, according to M. Antillon, the errors in the maps of California. He is even said to have first discovered that this vast country was a peninsula; but in the sixteenth century nobody in Mexico denied this fact, which was long afterwards doubted in Europe.†

I reckon among the operations somewhat doubtful, those which were executed by several Spanish engineer officers in the frequent and laborious visits which they made to the small forts situated on the northern frontiers of New Spain. I procured at Mexico the itineraries of brigadier Don Pedro de Rivera, drawn up in 1724; those of Don Nicholas Lafora, who accompanied the Marquis de Rubi in his researches, in 1765, as to a line of defence for the *provincias internas;* and the manuscript travels

* In the original, *de la quelle ils passèrent de la Tarahumara à Colhuacan.* Translator.

† In 1539, Francisco de Ulloa, in an expedition undertaken at the expense of Cortez, explored the gulf of California to the mouth of the Rio Colorado. The idea of California's being an island has its date only in the seventeenth century. (*Antillon, Analysis,* p. 47. No. 55.)

of the engineer Don Manuel Mascaro from Mexico to Chihuahua and Arispe.* These respectable travellers assure us, that they made observations of the meridian altitude of the sun. I know not what instruments they made use of; and it is to be feared that the manuscripts which came into my hands are not a lways exactly copied; for having taken the trouble to calculate the latitudes by the rhombs and distances indicated, I found results which coincided very ill with the latitudes observed. MM. Bauza and Antillon at Madrid made the same observation. I regret that none of the observations of latitude of the engineer officers are connected with places whose position has been determined by M. Ferrer or myself. M. Mascaro indeed observed at Queretaro. We differ 10′ in the latitude of that city; but my result being founded on a method analogous to Douwes', is doubtful to nearly the extent of 2′. Notwithstanding these uncertainties, the materials of which I have spoken are of great use to those who would draw up maps of a part of the world so little visited by people of information. We shall content ourselves with discussing some of the most important points.

Mr. Jefferson, in his classical work on Virginia, has discussed the position of the Presidio de S. Fe in New Mexico; he believes it to lie in 38° 10′ of

* 1. Derotero del Brigadier Don Pedro de Rivera en la visita que hizo de los Presidios de las Fronteras de Nueva Espana en 1724.—2. Itinerario del mismo autor de Zacatecas a la Nueva Biscaya.—3. Itinerario del mismo autor desde el Presidio del Paso del Norte hasta el de Janos.—4. Diaria de Don Nicolas de Lafora en su Viage a las Provincias Internas en 1766.—5. Derotero del mismo autor de la villa de Chihuahua al Presidio del Paso del Norte.—6. Derotero de Mexico a Chihuahua por el Yngeniero Don Manuel Mascaro en 1778. —7. Derotero del mismo autor desde Chihuahua a Arispe Mission de Sonora.—8. Derotero del mismo autor desde Arispe a Mexico en 1785. The originals of these eight manuscripts are preserved in the archives of the viceroyalty of Mexico.

latitude; but striking a medium between the direct observations of M. Lafora and Fathers Velez and Escalante, we shall find 36° 12′. MM. Bauza and Antillon, by a union of ingenious combinations, and by connecting S. Fe with the Presidio de l'Altar, and this again with the coast of Sonora, found S. Fe de Nueva Mexico 4° 21′ to the west of the capital of Mexico.* The map of M. Antillon gives five degrees of difference. Without possessing any knowledge of the labours of these Spanish geographers, I arrived, by a different way, at a still greater result. I fixed the longitude of Durango by a lunar eclipse observed by Doctor Oteyza; this position agrees with the one adopted by M. Antillon; now, supposing the latitude of Durango 24° 30′, and that of Chihuahua, the capital of New Biscay, where M. Mascaro observed for a long time, 28° 45′, I have thus been able to estimate the value of the leagues indicated in the itinerary of Brigadier Rivera. The distances and rhombs gave me by graphical construction the difference of the meridians of Durango and Chihuahua 53′, from whence there results a difference of longitude between Mexico and Santa Fe of 5° 48′. It is natural enough that this difference should appear greater than what is indicated by MM. Bauza and Antillon, for these estimable geographers place the capital of Mexico 37′ *en arc* too far to the west. The position assigned by them to Santa Fe depends, however, more on the longitudes of S. Blas and Acapulco than on that of Mexico. I found Santa Fe at 107° 14′ of absolute longitude, MM. Bauza and Antillon at 107° 2′; a longitude extremely probable, but 5° 28′ more eastern than what is to be found in the map of west Louisiana published at Philadelphia in 1803. The same map is nearly four degrees

* *Analysis de la Carta*, p. 44.

false in the position of Cape Mendocino, notwithstanding the observations of Vancouver and the Spaniards. On the other hand, M. Costanzo concluded from a great number of combinations, that Santa Fe and Chihuahua were 4° 57′ and Arispe 9° 5′ to the west of Mexico. In all the old manuscript maps which I have consulted, particularly in those constructed since the return of M. Velasquez from California, Durango is placed three degrees to the east of the Parral and of Chihuahua. Velasquez reduced this difference of meridians to an arc of three minutes; but a graphical method, founded on itineraries, gives me 50′.

I was equally well pleased to see that on another point of the geography of New Spain, my combinations conducted me to the same result that had been obtained by the learned astronomers of Madrid. My map constructed at Mexico, the same year in which M. Antillon published his Analytical Memoir,* indicates, as is proved by the copies deposited in Mexico, the difference of meridians of Tampico and Mazatlan (that is to say, the breadth of the kingdom from the Atlantic Ocean to the South Sea, to be 8° 0′. MM. Bauza and Antillon found it 8° 20′ while the map of Lafora gives 17° 45′, and that of the West Indies by Arrowsmith, 9° 1′. In my map I have connected Tampico with the Bar de Santander, of which the longitude was observed by M. Ferrer, supposing, agreeably to the maps of the marine depot of Madrid, Tampico 10′ east of the Bar. We shall return in the sequel to the position of this port.

The latitude of the city of Zacatecas, celebrated for the great wealth of its mines, was determined by the Count de Santiago de la Laguna, not by astronomical rings, or by gnomons, but by means of se-

* Analysis de los fundamentos de la Carta de la America septentrional.

veral quadrants of from three to four feet radius, constructed in the country itself; it was found 23° 0′. Don Francisco Xavier de Zarria concluded, from various gnomical observations, the latitude to be 22° 5′ 6″. These observations are to be found in a work almost unknown in Europe, the Chronicle, published by the fathers of S. Francis of Queretaro at Mexico. Zacatecas was formerly believed half a degree farther north, as is proved by a small Table of Latitude, published at Mexico, by Don Diego Guadalaxara, for the use of those desirous of constructing gnomons. The Count de la Laguna asserts, that he found the longitude of Zacatecas 4° 3′ to the west of Mexico; but this result is probably very false. After fixing the position of Guanaxuata by the chronometer, and by lunar distances, I deduced from rhombs and estimated itinerary distances, a difference of meridians of 2° 32′. The calculations of M. Mascaro's itinerary give 3° 45′. As to the absolute longitude, the count fixes it in a manner equally erroneous. He pretends to have concluded from a corresponding observation of an eclipse at Bologna, that Zacatecas is 7h 13′ 50″ to the west of that city, which would give 7h 13′ 59″ of longitude for Zacatecas, and consequently 7h 3′ 39″ (in place of 6h 45′ 42″) for Mexico. Can an error have glided into the figures? Perhaps the difference of meridians is 7h 30′ in place of 7h 50′.

The longitude of Durango should be very nearly 105° 55′. Don Juan Jose Oteyza, a young Mexican geometrician, the benefit of whose abilities I have often experienced in the course of my operation, observed there (at l'Hacienda del Ojo, 38′ to the east of Durango) the termination of an eclipse of the moon, which, compared with the old tables of Mayer, gave the result which we have already indicated. The author even did not consider it as completely accurate. M. Friesen concluded from

the rhombs and distances indicated in the itineraries of Brigadier Rivera and M. Mascaro, that this longitude was 5° 5′ to the east of Mexico, consequently 106° 30′. The latitude of Durango appears sufficiently doubtful. Rivera and his companion Don Francisco Alvarez Bareiro pretend to have found it, by meridian altitudes of the sun, 24° 38′; Lafora, in 1766, 24° 9′; but we do not know what instruments these engineers made use of. If the latitude which the Count de la Laguna, M. Zarria, and the engineer Mascaro assign to the city of Zacatecas is exact, that of Durango, deduced from the rhombs and distances, should be nearly 24° 25′.

There are several places in the northern provinces of New Spain, where the three engineers already cited made observations successively; this circumstance gives somewhat more confidence in the medium result.

Chihuahua.—Latitude, 29° 11′ according to Rivera, 28° 45′ according to Mascaro. Longitude deduced from the rhombs and distances, 5° 25′ to the west of Mexico.

Santa Fe.—Latitude, 36° 28′ by Rivera, 36° 10′ by Lafora. Longitude by approximation, 5° 48′ in relation to the meridian of Mexico.

Presidio de Janos.—Latitude, 31° 30′ by Rivera, 30° 50′ by Mascaro. Longitude, somewhat doubtful, 7° 40′ to the west of Mexico.

Arispe.—Latitude, 30° 30′ by Rivera, 30° 36′ by Mascaro. Longitude by approximation, 9° 53′ (from Mexico).

Geographical combinations founded on itineraries give an additional probability to the following positions, of which MM. Mascaro and Rivera determined the latitude. These results adopted in my map, agree with what was obtained by MM. Bauza and Antillon. We differ, however, nearly a degree in the absolute longitude of Arispe, a city situated in

the province of Sonora, as well as in the longitude of the Paso del Norte, in New Mexico. But I have to repeat, that a part of these differences arises from M. Antillon's placing in his map Mexico, Acapulco, and the mouth of Rio Gila more to the eastward than I have done.

Places.	N. Latitude.	W. Longitude from Mexico.
Guadalaxara	21° 9′	3° 57′
Real del Rosario	23° 30′	7° 1′
Presidio del Pasage	25° 28′	4° 8′
Villa del Fuerte	26° 50′	9° 5
Real de los Alamos	27° 8′	9° 58′
Presidio de Buenavista	27° 45′	11° 3′
Presidio del Altar	31° 2′	2° 41′
Paso del Norte	32° 9′	5° 38′

On the formation of militia (*tropas de milicia*) in the kingdom of New Spain, there was drawn up a map of the province of *Oaxaca*, in which several places are found marked whose latitude (according to a remark of the author) had been observed astronomically. I do not know if these latitudes are founded on meridian altitudes taken with gnomons. The map bears the name of M. Don Pedro de Laguna, lieutenant-colonel in the service of his catholic majesty. These eleven points are partly situated on the coast between the two ports of Acapulco and

Tehuantepec, partly near the coast in the interior of the country. Proceeding from west to east we find

Places.	Latitude.
Ometepec	16° 37′
Xamiltepec	16° 7′
Barra de Manialtepec	15° 47′
Pochutla	15° 50′
Puerto Guatulco	15° 44′
Guiechapa	15° 25′

In la Misteca alta the position has been determined of

S. Antonio de las Cues at 18° 3′ of latitude.
Teposcolula - - 17° 18′.
Nochistlan - - 17° 16′.

We may add the village of Acatlan in the intendancy of la Puebla at 17° 58′, and the city of Oaxaca at 16° 54′, of latitude. These determinations, if they have any degree of accuracy, are so much the more precious, that from la Puebla de los Angeles to the isthmus of Panama, there was not hitherto a single point in the interior of the country whose latitude was astronomically determined. What gives us a certain degree of reliance on these positions, is the harmony which prevails between the latitudes assigned in the map of Don Pedro Laguna and in those of M. Antillon, to the city of Tehuantepec and to Puerto Escondido. Hence the Spanish navigators at present place the former port at 16° 22′, and the latter, which is in the neighbourhood of the village of Manialtepec, at 15° 50′ of latitude.

Hitherto we have discussed positions founded on astronomical observations, more or less worthy of the geographer's confidence; there remains for us to indicate the maps, almost wholly manuscript, which we have employed for the different ports of the general map of New Spain.

As to the bearings and sinuosities of the western coast washed by the great ocean, from the port of Acapulco to the mouth of the Rio Colorado, and to the volcanoes of the Virgins in California, I have followed the map which accompanies the account of the voyage of the Spanish navigators to the Straits of Fuca. This map, published in 1802 by the marine depot at Madrid, is founded on the operations of the corvettes of Malaspina, but the coast which stretches to the south-east of Acapulco, is still very imperfectly known. The map of North America by M. Antillon was consulted in its construction. There is ground for complaint against the inaccuracy with which the eastern coast of Mexico to the north of Vera Cruz has been hitherto surveyed. The part contained between the mouths of the Rio Bravo del Norte and the Mississippi is almost as little known as the eastern coast of Africa between Orange River and Fish Bay. The expedition of MM. Cevallos and Herera, provided with superb astronomical instruments, is engaged in taking exact plans of those desert and arid regions. Meanwhile I have followed, for the detail of the eastern coast, the map* of the gulf of Mexico, published by order of the king of Spain in 1799, and retouched in 1803. I have however corrected several points from the excellent observations of M. Ferrer, already cited. This able observer having placed the port of Vera Cruz 9′ 45″ less to the west than is done by me, I have re-

* Carta esferica que comprehende las costas del Seno Mexicano, construida en el Deposito Hidrografico de Madrid, 1799.

duced the positions of the places determined by him in the environs of Vera Cruz, to the longitude resulting from the calculations of M. Oltmanns. The error of the old maps consisted especially in the longitude of the bar of Santander, which, according to M. Ferrer, is 1° 45′ 15″ to the west of Vera Cruz, while the map of the Deposito admits 1° 23′ of difference of longitude. I have constantly followed the observations of M. Ferrer, in reducing the longitude of Tanuagua on that of Santander.

The territory comprised between the ports of Acapulco and Vera Cruz, between Mexico, Guanaxuata, the valley of Santiago and Valladolid, between the volcano of Jorullo and the Sierra de Toloco, is constructed from a great number of geodæsical surveys, taken by me either with a sextant or the graphometer of Adams. The part contained between Mexico, Zacatecas, Fresnillo, Sombrerete and Durango, is founded on a manuscript plan which M. Oteyza had the goodness to construct for me, from materials collected by him in his journey to Durango. Having marked with great exactness the rhombs and the distances estimated from the pace of the mules, his plan merits undoubtedly some confidence, particularly as the positions of Guanaxuata and S. Juan de Rio were corrected by direct observations of my own, independent of one another. By this means it became easy to convert time into distance, and to ascertain the value of the leagues of the country.

The journals of MM. Rivera, Lafora, and Mascaro, which we have already cited, were of assistance for the *provincias internas*, particularly for the routes from Durango to Chihuahua, and from thence to Santa Fe. and Arispe in the province of Sonora. However, these materials could only be employed after long discussions and comparisons with the data collected by M. Velasquez in his expedition to Cali-

fornia. The routes of Rivera very often differ a good deal from those of M. Mascaro; and we are particularly embarrassed as to the difference of meridians between Mexico and Zacatecas, or between Santa Fe and Chihuahua, as we shall afterwards have occasion to explain.

The geography of Sonora has been rectified by M. Costanzo. This philosopher, as modest as he is profound, has for thirty years been collecting whatever is connected with the geographical knowledge of this vast kingdom. He is the only engineer officer who has addicted himself to discussions on the difference in longitude of the most distant points from the capital. He has himself formed very interesting plans, in which we may perceive how far ingenious combinations may, to a certain point, supply the want of astronomical observations. I render this justice to M. Costanzo with the more pleasure, as I have seen many manuscript maps in Mexico, of which the scales of longitude and latitude appeared merely as an accidental ornament.

The following is an enumeration of the maps and plans consulted by me for the detail of my map; I think I have brought together every thing of importance which existed up to 1804.

*Carte manuscrite de la Nouvelle Espagne, dressée par ordre du vice-roi Buccarelli, par MM. Costanzo et Mascaro.** It comprehends the immense space between the 39° and 42° of latitude, and extends from Cape Mendocino to the mouth of the Mississippi. Much care appears to have been bestowed on this work, which has served me for the Moqui, for the environs of the Rio Nabajoa, and for

* Manuscript map of New Spain, constructed by order of the Viceroy Buccarelli, by MM. Costanzo and Mascaro. *Trans.*

the route of the Chevalier la Croix in 1778, from Chihuahua to Cohahuila and Texas.

*Mapa del Azobispado de Mexico, por Don Jose Antonio de Alzate,** a manuscript map drawn up in 1768, and revised by the author in 1772, and which, so far at least as I have examined it, is very bad. Several mining places are to be found in it, which are interesting for the mineralogist.

I have made no use of the map of New Spain, published at Paris in 1765, by M. *de Fer*, nor of that of Governor Pownall, published in 1777, nor even of the map of Siguenza, which the academy of Paris engraved under the name of Alzate, and *which has been hitherto looked on as the best map of Mexico.*

Carte generale de la Nouvelle Espagne† from the 14° to the 27° of latitude, drawn up by M. Costanzo. This manuscript map is valuable for an acquaintance with the coast of Sonora. I consulted it also for the part which stretches out from Acapulco to Tehuantepec.

Carte manuscrite des côtes depuis Acapulco jusqu à Sonzonate,‡ executed by the brigantine *Activo*, in 1794.

Carte manuscrite de toute la Nouvelle Espagne, dressée par M. Velasquez, en 1772.§ It comprises the countries situated between the 19° and 34° of latitude, between the mouth of the Rio Colorado, and the meridian of Cholula. It was destined to exhibit the situation of the most remarkable mines of New Spain, particularly those of Sonora.

* Map of the archbishopric of Mexico, by Don Joseph Antonio de Alzate. *Trans.*

† General map of New Spain.

‡ Manuscript map of the coast from Acapulco to Sonzonate. *Trans.*

§ Manuscript map of the whole of New Spain, drawn up by M. Velasquez in 1772. *Trans.*

*Carte manuscrite d'une partie de la Nouvelle Espagne,** from the parallel of Tehuantepec to that of Durango, drawn up by order of the viceroy Revillagigedo, by *Don Carlos de Urutia.* This is the only map of the country which exhibits the division into intendancies, and it has been very useful to me in this respect.

Mapa de la Provincia de la Compania de Jesus de Nueva Espana,† engraved at Mexico in 1765. Is it by mere accident that this map, so bad in other respects, places Mexico at 278° 26′ of longitude, while the same capital is fixed at 270° of longitude, in the map which bears the title *Mapa de distancias de los lugares principales de Nueva Espana,*‡ engraved by the Jesuits at la Puebla de los Angeles, in 1755?

I found at Rome, *Provincia Mexicana apud Indos ordinis Carmelitarum* (*erecta* 1588) *Romæ*, 17..8. Mexico is there placed in 20° 28′ of latitude!

Father Pichardo de San Felipe Neri, a very well informed ecclesiastic, who possesses the small quadrant of the Abbé Chappe, was so kind as to furnish me with two manuscript maps of New Spain, the one by *Velasquez*, and the other by *Alzate.* They both differ from the map engraved by the academy of Paris, and are curious, as they exhibit the situation of several remarkable mining places.

Environs de Mexico; a map of Siguenza, republished by Alzate in 1786. Another map of the valley of Mexico is to be found annually in the almanac, entitled *la Guia de Forasteros;* (the Stranger's Guide;) it is by M. Mascaro. Neither these two plans, nor the one published by Lopez in 1785, exhibit the lakes in their actual situations. In the map

* Manuscript map of a part of New Spain. *Trans.*

† Map of the Jesuits' province of New Spain. *Trans.*

‡ Map of distances of the principal places of New Spain. *Trans.*

of Lopez, the degrees of longitude are marked on the meridian, a strange mistake for a geographer to the king!

Carte detaillée des environs du Doctor, du Rio Moctezuma, (which receives the waters of the canal of Huehuetoca,) *et de Zimapan, par M. Mascaro.** The environs of *Durango*, of *Toluca*, and of *Temascaltepec* are to be found carefully represented in plans constructed by M. Juan Jose Oteyza.

Carte manuscrite de tout le royaume de la Nouvelle Espagna, depuis le 16° au 40° de latitude, *par Don Antonio Forcada y la Plaza*, 1787.† This map appears to be ably constructed. Those who know the localities, entertain the same opinion of the manuscript map of the *audience of Guadalaxara*, drawn up by M. Forcada in 1790.

Carte du pays compris entre le meridien de Mexico et celui de Vera Cruz, dressée par Don Diego Garcia Conde,‡ lieutenant-colonel and director of highways. This manuscript map is founded on the joint observations of M. *Costanzo* and M. Garcia Conde. It is a series of triangles measured by the graphometer and compass. This work was executed with great care; and it exhibits, above all, a great minuteness in the part which includes the slope of the Cordilléra from Xalappa and Orizaba to Vera Cruz.

Carte des routes qui vont de Mexico a la Puebla, au nord et au sud de la Sierra Nevada,§ drawn up by

* Minute map of the environs of the Doctor, of the Rio Moctezuma, and of Zimapan, by M. Mascaro. *Trans.*

† Manuscript map of the whole kingdom of New Spain, by Don Antonia Forcada y la Plaza, 1787. *Trans.*

‡ Map of the country comprised between the meridians of Mexico and Vera Cruz, constructed by Don Diego Garcia Conde. *Trans.*

§ Map of the roads from Mexico to la Puebla, to the north and south of the Sierra Nevada. *Trans.*

order of the viceroy, the Marquis de Branciforte, by *Don Miguel de Costanzo.*

*Plan manuscrite des environs de Vera Cruz.**—It extends to Perote, and indicates at the same time the difference of the roads projected from Xalappa to Vera Cruz.

Carte manuscrite du terrain contenu entre Vera Cruz et le Rio Xamappa, 1796.†

Carte manuscrite de la province de Xalappa, avec les environs detaillés de l'Antigua et de la Nueva Vera Cruz.‡

Carte manuscrite de la province d'Oaxaca et de toute la côte, depuis Acapulco a Tehuantepec *dressée par Don Pedro de la Laguna.*§—This map is founded on eleven positions, which are asserted to have been determined in latitude, by direct observations. As to the Rio Huasacualco, celebrated from the project of a canal to unite the South Sea with the Atlantic Ocean; I have assigned to it the course which I found traced in the plans of the two engineer officers, *Don Augustin Cramer*, and *Don Miguel del Corral.* These plans are preserved in the archives of the vice-royalty of Mexico.

Mapa anonimo de la Sierra Gorda, dans la province de Nuevo Santander,‖ from the 21° to the 29° of latitude, a manuscript map painted on vellum, and ornamented with figures of Indian savages. It is very

* Manuscript plan of the environs of Vera Cruz. *Trans.*

† Manuscript map of the country between Vera Cruz and the Rio Xamappa, 1796. *Trans.*

‡ Manuscript map of the province of Xalappa, with a detail of the environs of Antigua and la Nueva Vera Cruz. *Trans.*

§ Manuscript map of the province of Oaxaca and the whole coast from Acapulco to Tehuantepec, drawn up by Don Pedro de la Laguna. *Trans.*

‖ Anonymous map of the Sierra Gorda, in the province of Nueva Santander. *Trans.*

exact for the environs of Sotto la Marina and of Ca
margo.

The course of the rivers contained between th
Rio del Norte and the mouth of the Rio Sabina wa
copied from a manuscript map which General Wi
kinson communicated to me at Washington, on hi
return from Louisiana.

*Mapa de la Nueva Gallizia;** a manuscript ma
constructed in 1794, by *M. Pagaza*, from his ow
observations and the map of M. Forcada.

*Carte de la Province de Sonora et de la Nouvel
Biscaye*† dedicated to M. d'Azanza, and constructe
at Cadiz, by the engineer *Don Juan de Pagaza*. Th
manuscript map, four feet in length, is very minu
as to the mountainous places, where the savage In
dians conceal themselves for excursions and attack
on travellers. It is also very minute as to the env
rons of the Paso del Norte, and particularly as to th
desert territory called the *Bolson de Mapimi*.

Carte manuscrite de la Sonora,‡ from the 27°
the 36° of latitude, dedicated to Colonel *Don Ja
Tienda de Cuervo*. The author of this map appea
to have been a German Jesuit, who had resided
the *Pimeria alta*, that is to say, in the most northe
part of the province of Sonora.

Carte manuscrite de la Pimeria alta.§ It extend
to the Rio Gila. The famous ruins of the Cas
grandes are placed there at 36° 20′ of latitude,
error of three degrees!

Mapa de la California, a manuscript map of F
thers Francisco Garces and Pedro Font, 1777.
has also been engraved at Mexico, but with an err
of a diminution of three minutes for all the latitude

* Map of Nueva Gallizia. *Trans.*

† Map of the province of Sonora and of New Biscay. *Tra*

‡ Manuscript map of Sonora. *Trans.*

§ Manuscript map of the Pimeria alta.

It is interesting for la Pimeria alta and the Rio Colorado.

Carta geografica de la Costa occidental de la California que se descubrió en los anos 1769 *y* 1775, *por Don Francisco de Bodega y Quadra y Don Jose Canizares, desde los* 17 *hasta los* 58 *grados.** This small map engraved in 1788 by Manuel Villavicencio at Mexico, is drawn up on the meridian of S. Blas. It must interest those who study the history of discoveries in the great ocean.

The gulf of Cortez appears very much detailed in the map of California, which accompanies the *Noticia de la California del Padre Fr. Miguel Venegas*, 1757; but the true position of the missions actually existing in this peninsula is indicated in the map subjoined to the life of the Father *Fray Junipero Serra*, printed at Mexico in 1787.

Carte manuscrite de la province de la Nouvelle Biscaye,† from the 23° to the 37° of latitude, drawn up in 1792 by the engineer *Don Juan de Pagaza Urtundua*, from information obtained at Chihuahua. This curious work was executed by order of M. de Nava, captain-general of the *provincias internas*. It served me for the whole intendancy of Durango; though the environs of the town of Durango do not appear very accurate.

Carte manuscrite des frontieres septentrionales de la nouvelle Espagne,‡ from the 23° to the 37° of latitude, by the engineer *Don Nicolas Lafora*. It develops the plan of defence of the Marquis de Rubi, and served me for verifying the situation of the small forts

* Geographical map of the western coast of California, discovered in 1769 and 1775, by Don Francisco de Bodaga y Quadra and Don Jose Canizares, from the 17° to the 58°. *Trans.*

† Manuscript map of the province of New Biscay. *Trans.*

‡ Manuscript map of the northern frontiers of New Spain. *Trans.*

named *Presidios*. I saw a copy of this same map, t
metres* in length, in the archives of the viceroy
Mapa del Nuevo Mexico,† from the 29° to
42° of latitude. This manuscript map is very
nute with regard to the countries situated under
parallel of 41°. It contains details as to the lake
Timpanogos, and the sources of the *Rio Colo*
and the *Rio del Norte*.

Carte du nouveau Mexique, gravée en 1795,
Lopez.‡ I have made no use of it. It appears
ceedingly defective as to the sources of the *Rio*
Norte. The countries situated between these sou
and those of the Missouri are better detailed i
Map of Louisiana published at Philadelphia
1803.

I flatter myself that, notwithstanding great im
fections, my general map of New Spain has two
sential advantages over all those which have hith
appeared. It exhibits the situation of three hund
and twelve mines, and the new division of the cou
into intendancies: those mines which have b
worked are there indicated from a catalogue wh
the supreme tribunal of mines caused to be dra
upon the spots, through the whole extent of that
empire. I have distinguished by particular signs
places which are the seats of the *Deputaciones de*
nas, and the sites of the mines which depend on th
The catalogue with which I was furnished very of
marked the rhomb and the distance from some m
considerable town. These notes I combined w
what I found in the old manuscript maps, amo
which those of Velasquez were of the greatest assi
ance to me. This labour was equally minute a
troublesome. When any map did not bear the na

* Nine feet ten inches English. *Trans.*

† Map of New Mexico. *Trans.*

‡ Map of New Mexico, engraved in 1795, by Lopez. *Tra*

of the mine, I placed it simply according to the situation in the catalogue, reducing the itinerary distances or leagues of the country into absolute distances, from combinations furnished by analogous cases. The population of New Spain being concentrated on the great interior plain of the central chain, it follows that the map of Mexico is covered very unequally with names. It must not however be supposed that there are districts entirely uninhabited, wherever the map indicates neither village nor hamlet. I wished only to enter places whose position was the same in several manuscript maps from which I laboured; for the most part of the American maps, executed in Europe, are filled with names whose existence is unknown in the country itself. These errors are perpetuated, and it often becomes extremely difficult to conjecture their origin. I chose rather to leave a vacant space in my map than to draw from suspicious sources.

The indication of the chains of mountains presented difficulties which can only be felt by those who have been themselves employed in constructing geographical maps. I preferred *hatchings* (hachures) in orthographical projection, to the method of representing mountains in profile. This last, the oldest and most imperfect of all, occasions a mixture of two sorts of very heterogeneous projections. Yet I will not dissemble that this inconvenience is almost balanced by a real advantage. The old method furnishes signs which announce vaguely "that the country is hilly, that there exists mountains in such or such a province." The more this hieroglyphical language is vague the less it exposes to error. The method of hatching, on the contrary, forces the drawer to say more than he knows, more than it is even possible to know of the geological constitution of a vast extent of territory. To look at the last maps of Asia Minor and Persia, one would believe that learned geologists

have ascertained the relative height, the limits, and direction of the mountains. We discover their chains which wind and branch out like rivers; we are tempted to believe that the Alps and Pyrenees are less known than these distant countries. However, well informed people who have gone through Persia and Asia Minor assert, that the grouping of the mountains there differs entirely from the form in which they appear in the large map of Asia, published by Arrowsmith, so often copied both in France and Germany.

The waters undoubtedly in some sort give the delineation of the country; but the courses of rivers merely indicate the difference of level which exists in the extent of territory through which they run. A knowledge of the great valleys or of the basins; an examination of the points where rivers take their rise, are certainly extremely interesting to a hydrographical engineer; but it is a false application of the principles of hydrography, when geographers attempt to determine the chains of mountains in countries of which they suppose they know the course of the rivers. They suppose that two great basins of water can only be separated by great elevations, or that a considerable river can only change its direction when a group of mountains oppose its course. They forget that frequently, either on account of the nature of the rocks, or on account of the inclination of the strata, the most elevated levels give rise to no river, while the sources of the most considerable rivers are distant from the high chains of mountains. Hence the attempts which have been hitherto made to construct physical maps from theoretical ideas have never been very successful. For the true configuration of the earth is so much the more difficult to be discovered, as the pelagick currents, and the greater number of the rivers which have changed the surface of the globe, have totally disappeared. The most

MEXICO

perfect acquaintance with those which have existed, and those which actually exist in our days, might instruct us as to the slope of the valleys, but by no means as to the absolute height of the mountains, or the position of their chains.

I have traced on my map of New Spain the direction of the Cordilleras, not from vague suppositions or hypothetical combinations, but from a great variety of data furnished by persons who had visited the Mexican mines. The most elevated group of mountains is to be found in the environs of the capital, under the 19° of latitude. I examined myself the part of the Cordilleras of Anahuac, between the parallels of 16° 50′ and 21° 0′, for a breadth of more than 140 leagues. It was in this region that I made the greatest number of barometrical and geodæsical measurements, of which the results served for my geological sections. The manuscript maps of M. Velasquez, and of MM. Costanzo and Pagaza, were of great use to me for the northern provinces. M. Velasquez, director of the *Tribunal de Mineria*, travelled over the greater part of New Spain; and he traced on the map which we have already cited the branches of the *Sierra Madre de Anahuac*, the *eastern branch* which runs from Zimapan towards Charcas and Monterey, in the small kingdom of Leon, and the western branch which extends from Bolanos to the Presidio de Fronteras. The manuscript memoirs of M. Sonnenschmidt, a learned Saxon mineralogist, who visited the mines of Guanaxuato, Zacatecas, Chihuahua and Catorce, and the labours of M. del Rio, professor in the school for mines of Mexico, and of Don Vincente Valencia, residing at Zacatecas, have also furnished me with very useful information. I owe much also to the celebrated D'Elhuyar at Mexico; M. Chovell at Villalpando; M. Abad at Valladolid; M. Anza at Tasco; Colonel Obregon at Catorce; and a great number of rich proprietors

of mines and religious missionaries, who were so good as to take an interest in my work. Notwithstanding all the pains I took to be informed as to the direction of the chains of mountains, I am far from regarding this part of my work as perfect. Occupied these twenty years in examining mountains and collecting materials for a geological atlas, I well know how hazardous an undertaking it is to trace the mountains on an extent of territory of 118,000 square leagues.

I could have wished to draw up on a large scale two maps of New Spain, the one physical, the other purely geographical; but I was afraid of rendering the work too voluminous. The hatchings which designate the slope and undulation of the ground, afford at the same time a shade to the maps overcharged with names. These names become not unfrequently illegible, when an engraver attempts to produce a grand effect by the distribution of chiaro scuro. Hence the geographer who has carefully discussed the astronomical position of the places becomes uncertain whether he ought to preserve distinctness of character, or render more perceptible the relative height of mountains. One of the most beautiful maps which was ever published in France,* the one drawn up in the war depot in 1804, sufficiently proves how difficult it is to reconcile two opposite interests, the interest of the geologist and that of the astronomer. The fear of giving too great an extent to my work, and the difficulties attending the publication of an atlas of which no government defrays the expense, made me abandon a project which I

* We have discussed in the eighth chapter the extraordinary regularity in the position of the Mexican volcanoes. I am uncertain as to the longitude of the *Pic de Tancitaro*, which has been twice surveyed from a distance. I fear some error has crept in at copying the angles; but the latitude of this Pic is sure enough to within about eight minutes.

had once formed of joining to each section of territory a physical map in a horizontal projection.

II. MAP OF NEW SPAIN AND THE CONTERMINOUS COUNTRIES ON THE NORTH AND EAST.

I have already explained the motives by which I was induced to curtail my large map of New Spain within too narrow limits for representing, on the same plate, the whole extent of the kingdom from New California to the intendancy of Merida. The second map is destined to remedy this inconvenience. It shows at once, not only all the provinces which depend on the viceroy of Mexico and the two commandants of the *provincias internas*, but also the island of Cuba, whose capital may be considered as the military port of New Spain, Louisiana, and the Atlantic part of the United States. This map was drawn up by M. Poirson, an able engineer of Paris, from materials furnished to him by M. Oltmanns and me. It embraces the immense extent comprehended between the 15° and 42° of latitude, and the 75° and 130° of longitude. At first I meant to extend this map to the south as far as the mouth of the Rio San Juan, for the sake of indicating different canals, of which the construction was proposed to the court of Madrid, and which would serve to establish the communication between the two seas, to be discussed in the second chapter of this work. But on perceiving that the peninsula of Yucatan, and the coast of Monterey, would not be represented with the development which they deserved, I chose rather to preserve a larger scale, and to extend my map no farther south than the gulf of Honduras.

The principal part, that which comprehends the kingdom of New Spain, is a faithful copy of my

large map, of which I have given an analysis. The Yucatan, was added from the map of the gulf of Mexico, published by the *Deposito Hydrografico* of Madrid. New California was taken from the atlas which accompanies the account of the voyage of the corvettes *Sutil* and *Mexicana*, and from a memoir of M. Espinosa, printed in 1806, entitled, *Memoria sobre las observaciones astronomicas que han servido de fundamento a las cartas de la costa N. O. de America, publicadas por la direccion de trabajos hidrograficos.* When this memoir gave different results from those contained in the *Relacion del viage a Fuca*, they were preferred as founded on more solid bases.* The work of M. Espinosa served me also for the small group of islands, named by M. Collnett the archipelago of Revillagigedo, in honour of a Mexican viceroy.

The islands of San Benedicto, Socorro, Rocca partida and Santa Rosa, situated between the 18° and 20° of latitude, were discovered by the Spanish navigators in the commencement of the sixteenth century. Hernando de Grixalva discovered in 1533 the island of Santo Tomas, now named Isle del Socorro. In 1542, Ruy Lopez de Villalobos landed on a small island, to which he gave the name of la Nublada. He indicated very well its true distance from the island of Santa Tomas. This Nublada of Villalo-

* I have placed Monterey in latitude 36° 35′ 45″, and longitude 124° 12′ 23″, and Cape S. Lucas in latitude 22° 52′ 33″, longitude 112° 14′ 30″. The longitude of Monterey which I have definitively adopted with M. Espinosa, differs less from that of Vancouver than the result published by M. Antillon. The difference between the opinion of the Spanish navigator and that of the English navigator is only an arc of 18′ as already stated. (Here it is of importance to observe, that the commencement of this geographical introduction, from p. i. to p. xxxiii. was composed at Berlin in the month of September, 1807, and that the remainder was published in the spring of 1809).

los is now called San Benedicto. It is not so certain that the Rocca partida of the same navigator is the island of Santa Rosa of the modern hydrographers, for the greatest confusion prevails as to the position of this rock. Juan Gaëtan* places it even two hundred leagues to the west of the island of *Santa Tomas*.

This last island is marked at 19° 45′ of latitude, and as a shallow of thirty-six miles in length, on the map of Domingo de Castillo drawn up in 1541, and found in the archives of the family of Cortez at Mexico. Since that time the group of islands of Revillagigedo has only been thrice seen; namely, by the pilot Don Josef Camacho, in 1779, in a navigation from San Blas to New California; by captain Don Alonzo de Torres, in 1792, in a voyage from Acapulco to San Blas; and lastly, by M. Collnett† in 1793. The observations of these three navigators are extremely discordant. Yet it would appear that M. Collnett has fixed exactly enough the position of the Isle del Socorro, from several series of distances of the moon from the sun. It is from these same distances calculated by Mason's tables that the whole group of islands has been thrown too far east.

As to the countries conterminous with New Spain, we have used for Louisiana the fine map of the engineer Lafond; and for the United States, the map of Arrowsmith, rectified from the observations of

* Ramusio, T. I. p. 375. (edition of Venice, 1613).

† Collnett's voyage to the South Sea, p. 107. M. Collnett finds the latitude of Cape San Lucas 22° 45′, and the longitude 112° 20′ 15″. This latitude appears to be nearly seven minutes false! The mountain of San Lazaro, whose position is fixed by M. Collnett at 25° 15′ of latitude, and 114° 40′ 15″ (p. 92 and 94.) is undoubtedly not the same as that which Ulloa called, in 1539, Cape of San Abad, and which I have placed (after M. Espinosa) in 24° 47′ latitude, and 114° 42′ 30″ longitude.

Rittenhouse, Ferrer, and Ellicott. The positions of New-York and Lancaster were discussed by M. Oltmanns in a scientific memoir inserted in the second volume of my collection of Astronomical Observations, p. 92. The same work contains the materials which have served for the island of Cuba. It would be superfluous to enter into greater details on a part which is merely an accessory of this map. Several points situated in the interior of the island of Cuba, and on the southern coast, between the ports of Batabano and Trinidad, were fixed by the astronomical observations which I made there, in 1801, before my departure for Carthagena.

III. MAP OF THE VALLEY OF MEXICO, OR, THE ANCIENT TENOCHTITLAN.

Few countries inspire so varied an interest as the valley of Tenochtitlan. It is the site of an ancient civilization of American people. Recollections, the most affecting, are associated, not only with the city of Mexico, but with more ancient monuments, the pyramids of Teotihuacan, dedicated to the sun and moon, of which a description will be given in the third book of this work. Those who have studied the history of the conquest, delight to trace the military positions of Cortez, and of the Tlascaltec army. The naturalist contemplates with interest the immense elevation of the Mexican soil, and the extraordinary form of a chain of porphyritic and basaltic mountains, which surround the valley like a circular wall. He perceives that the whole valley is at the bottom of a dried up lake. The basins of fresh and salt water which fill the centre of the plain; and the five marshes of Zumpango, San Christobal, Tezcuco, Xochimilco, and Chalco, are to the eye of the geo-

logist the small remains of a great mass of water, which formerly covered the whole valley of Tenochtitlan. The works undertaken for the preservation of the capital from the danger of inundations, if they do not offer to the engineer or hydraulic architect models for imitation, are at least objects worthy of fixing his attention.*

Notwithstanding the interest which this country offers in the triple relation of history, geology, and hydraulic architecture, there exists no map from the inspection of which any idea can be conceived of the true form of the valley. The plan of the environs of Mexico, published at Madrid by Lopez in 1785, and that of the *Guia de Forasteros de Mexico*, are founded on an old plan of Siguenza, drawn up in the seventeenth century. These sketches certainly do not merit the name of topographical maps; for they neither represent the actual situation of the capital, nor the state of the lakes in the time of Montezuma.

The plan of Siguenza, which is only twenty-one centimetres by sixteen,† is entitled *Mapa de las aguas que per el circulo de noventa leguas vienen a la laguna de Tezcuco, delineado por Don Carlos de Siguenza y Gongora, reimpreso en Mexico con algunas adiciones en* 1786, *por Don Joseph Alzate.* The scale of latitudes and longitudes attached by M. Alzate to this plan of Siguenza is defective in construction to the extent of more than an arc of three

* See what I afterwards say on the position of the old city of Mexico; on the pyramids of Teotihuacan; on the position of the lakes; on the artificial canal (Desague) by which the waters of the valley are drawn off into the gulf of Mexico; on the two plains of Cholula and Toluca, of which a part is also comprised in my map of the valley of Tenochtitlan. chap. viii.

† Eight inches by six. *Trans.*

minutes. The absolute longitude of the city, asserted by the learned Mexican to be the result of twenty-one observations of satellites of Jupiter, and believed by him to have been *approved* of and *verified* by the Academy of Sciences at Paris, is a degree false. This plan of M. Alzate has been servilely copied by all the geographers who have attempted to publish maps of the valley of Mexico. It gives the direct distance

a From the summit of the volcano of Popocatepetl to the village of Tesayuca, situated at the northern extremity of the valley, an equatorial arc of 1° 1′. (True distance 0° 53′.)

b From the centre of the city of Mexico to Huehuetoca, where the canal for the discharge of the lakes commences, 0° 32′. (True distance 0° 23′.)

c From Mexico to Chiconautla, 0° 20′. (True distance 0° 15′.)

d From the rock (Penol) de los Banos to Zumpango, 0° 32′. (True distance 0° 21′.)

e From the Penol de los Banos to San Christobal, 0° 13′. (True distance 0° 8′.)

f From the village of Tehuiloyuca to Tezcuco 0° 29′. (True distance 0° 21′.)

Here are errors of 16,000, even of 20,000* metres, in distances which M. Velasquez, in a geodæsical operation in 1773, had measured with great accuracy, and as to which there does not remain a doubt of a hundred metres.† And yet M. Alzate might have availed himself of the triangles of Velasquez, as was done by Don Luis Martin, M. Oltmanns, and myself, in constructing the map which is inserted in this work. I made no astronomical observations at Pachuca, but I did so at the Real de Moran, whose latitude is greater than that of Pachuca. I found the latitude of

* About twelve miles and a half. *Trans.*

† About 109 yards. *Trans.*

Moran 20° 10′ 4″, and yet M. Alzate makes Pachuca 20° 14′. The old city of Tula is placed in his map too far north by nearly a quarter of a degree.

The plan of M. Mascaro, published in the *Guia de Mexico* (*Mapa del as cercanias de Mexico*) is only fourteen centimetres by ten,* consequently it is about twelve times smaller than the one annexed to this work. It may be considered as a copy of the plan of Siguenza and Alzate. The northern part of the valley has, however, been somewhat straitened. The summit of the volcano of Popocatepetl is distant from Huehuetoca, according to Father Alzate, 1° 14′; and according to M. Mascaro 1° 11′. The true distance is 1° 1′, which results from connecting, by the triangles of Velasquez, Huehuetoca with the rock de los Banos, and this rock, by my astronomical observations, and by several azimuths, with the volcano of Popocatepetl and the pyramid of Cholula.

There exist maps, according to which the waters of the lakes adjoining the city of Mexico do not run north-east towards the gulf of Mexico, as is really the case, but north-west to the South Sea. This error is to be found along with many others in the map of North America, published at London by M. Bower, geographer to the king.

On my arrival at Mexico in the spring of the year 1800, I conceived the project of drawing up a map of the valley of Tenochtitlan. I proposed to fix, by astronomical observations, the limits of this valley, which has the form of a lengthened oval. I took besides a great number of angles of positions, from the tower of the cathedral of Mexico, the summit of the porphryry hills of Chapoltepec, and the Penol de los Banos, the Venta de Chalco, the summit of the mountain of Chicle, Huehuetoca and Tissayuca. The position of the two volcanoes of la Puebla and the

* About five inches and a half by four. *Trans.*

peak of Axusco was determined by a particul hypsometrical method, that is to say, by angles of a titudes and azimuths. Having very little time t bestow on this work, I could not flatter myself wit bringing together in my map the great number small Indian villages, with which the banks of th lakes are covered. My principal aim was carefull to ascertain the form of the valley, and to draw up th physical map of a country in which I had measure a great number of elevations by means of the ba rometer.

Circumstances of a favourable nature have enable me to publish a topographical map from accurat materials. A respectable character, who, by a unio rarely to be found in any country, possesses with large fortune a strong love for the sciences, M. Do Jose Maria Fagoaga, wished to leave me a precio memorial of his country, in giving me at my depar ture from Mexico the sketch of a plan of the valley On his invitation, one of my friends, Don Luis Mar tin, as good a mineralogist as he is an able enginee drew up a map from the geodæsical operations ca ried on at different times between the city of Mexic and the village of Huehuetoca on account of the ca nals of Tezcuco, San Christobal, and Zumpango M. Martin joined to these materials a part of the sur veys communicated to him by me, in subjecting th delineation to the astronomical observations made b me at the extremities of the valley. The numerou excursions which he had undertaken from a zeal fo geology, enabled him to express, with a great deal o truth, the form and the relative height of the moun tains which separate the plain of Mexico from those o Tula, Puebla, and Cuernavaca.

This map, which I owe to the obliging friendshi of M. de Fagoaga, is not, however, the one which i inserted in this work. On examining and comparin it carefully, both with the triangulation of M. Velas

quez, the detail of which I possess in an original manuscript, and with the table of astronomical positions ascertained by my observations, I perceived that the eastern bank of the lake of Tezcuco, and the whole northern part of the valley, required considerable alterations. M. Martin himself discovered the inaccuracy of his first sketch, and I engaged M. Oltmanns to reconstruct under his eye the map of the valley from the materials which I had collected. Every point was separately discussed; and when several surveys disagreed with one another, the mean term was adopted.

The following is the chain of the triangles measured by M. Velasquez, in 1773, from the rock of the baths (Penol de los Banos,) near the city of Mexico to the mountain of Sincoque, to the north of Huehuetoca. The angles were measured with an excellent English theodolite of ten inches diameter, provided with two glasses of twenty-eight inches in length.

Number of the Triangles.		Names of the Stations.	Angles observed.	Reduced distances (in Mexican varas, of which 2.32258 make a toise.) Note, a toise is equal to 76.7862 inches. *Trans.*	
I.	A.	Garita de Guadalupe	57° 42′	From A to B	4474
	B.	Garita de Peralvillo	84° 57	From B to C	6233
	C.	Cumbre del Penol	37° 21′	From A to C	7346
II.	A.	Garita de Peralvillo	81° 27′		
	B.	Cumbre del Penol	40° 44′	From A to C	4806
	C.	San Miguel de Guadalupe	57° 49′	From B to C	7283
III.	A.	San Miguel de Guadalupe	62° 25′		
	B.	Cumbre del Penol	103° 31′	From A to C	29136
	C.	Tezcuco	14° 4′	From B to C	26560
IV.	A.	Cumbre del Penol	61° 35′		
	B.	Tezcuco	46° 25′	From A to C	20229
	C.	Cruzes del Cerro de S. Christobal	72° 0′	From B to C	24562
V.	A.	Tezcuco	35° 1′		
	B.	Cruzes del Cerro de S. Christobal	57° 19′	From A to C	20694
	C.	Creston de Chiconautla	87° 40′	From B to C	14100

Number of the Triangles.		Names of the Stations.	Angles observed.	Reduced distances (in Mexican varas, of which 2.32258 make a toise.) Note, a toise is equal to 76.7862 inches. *Trans.*	
VI.	A.	Creston de Chiconautla -	76° 35′		
	B.	Cruzes del Cerro de S. Christobal -	53° 3′	From A to C -	14633
	C.	Xaltocan - -	50° 22′	From B to C - -	17809
VII.	A.	Creston de Chiconautla -	59° 47′		
	B.	Cruzes del Cerro de S. Christobal	76° 8′	From A to C - -	19677
	C.	Hacienda de Santa Ines -	44° 5′	From B to C -	17513
VIII.	A.	Cruzes del Cerro de S. Christobal	23° 5′		
	B.	Hacienda de Santa Ines -	80° 46′	From A to C - -	17809
	C.	Xaltocan - - -	76° 9′	From B to C -	7072
IX.	A.	Xaltocan - - -	65° 19′		
	B.	Hacienda de Santa Ines -	71° 30′	From A to C -	11738
	C.	Zumpango - - -	36° 11′	From B to C - -	10884
X.	A.	Zumpango - - -	49° 34′		
	B.	Hacienda de Santa Ines -	74° 46′	From A to C - -	12718
	C.	Tehuiloyuca - - -	55° 40′	From B to C -	10033

Number of the Triangles.		Names of the Stations.	Angles observed.	Reduced distances in Mexican varas, (of which 2.32258 make a toise.) a toise is equal to 76.7662 inches.	Note, a *Trans.*
XI.	A.	Zumpango	57° 12′		
	B.	Tehuiloyuca	85° 30′	From A to C	20927
	C.	Sincoque (Cerro de)	37° 17′	From B to C	17647
XII.	A.	Tehuiloyuca	24° 30′		
	B.	Sincoque	29° 43′	From A to C	10783
	C.	Hacienda de Xalpa	125° 47′	From B to C	9020
XIII.	A.	Hacienda de Xalpa	32° 19′		
	B.	Sincoque	101° 44′	From A to C	12288
	C.	Loma del Potrero	47° 57′	From B to C	6709
XIV.	A.	Loma del Potrero	113° 50′		
	B.	Sincoque	37° 50′	From A to C	8672
	C.	Puente del Salto	28° 20′	From B to C	

M. Velasquez measured two bases, the one of 3,702½ Mexican varas in the plain, frequently inundated, which separates the village of San Christobal, and the hill of Chiconautla; and the other of 4,474 varas on the causey which leads from the capital to the sanctuary of S. Miguel de Guadalupe. The second base was even measured twice. In resolving successively the series of triangles according to these values, we shall find the direct distance from the cross of the mountain of San Christobal to the crest (Creston) of the Loma de Chiconautla. One of the bases gives for this distance 14,099 varas, another gives 14,101. The third triangle and the three last have each an obtuse angle, but in these same triangles an error of a minute in the sharpest angle would but produce a difference of three or four varas on the length of the sides. Hence this operation is very valuable for the topography of Tenochtitlan.

Particular signs indicate on my map the positions which are founded on the triangulation of M. Velasquez, and those which I determined astronomically. We have added the results of my measurements with the barometer, calculated according to the coefficient of M. Ramond. To facilitate the use of the map to those who study the history of the conquest, I have placed the ancient Mexican names, beside the names at present in use. I have endeavoured to be very exact in the Azteque orthography, following only Mexican authors, and not the works of Solis, Robertson, Raynal and Pauw, who disfigure the names of cities and provinces, like those of the kings of Anahuac.

IV. MAP, EXHIBITING THE POINTS WHERE COMMUNICATIONS HAVE BEEN PROJECTED BETWEEN THE ATLANTIC OCEAN AND SOUTH-SEA.

This map was drawn up for the sake of offering to the eye of the reader in one view the nine points which present means of communication between the two oceans. It will serve to explain what I have said in the second chapter of the first book. I have represented in nine assembled sketches the points of separation between the Ounigigah and the Tacoutche-Tesse, and those between the Rio Colorado and the Rio del Norte; the isthmuses of Tehuantepec, Nicaragua, Panama, and Cupica; the river of Guallaga, and the gulf of S. George; and, lastly, the ravin from the Raspadura to the Choco, by which, since 1788, boats have passed from the Pacific to the Atlantic Ocean. The most interesting sketches are those of the small canal of derivation from the Raspadura and the isthmus of Tehuantepec. I have traced the course of the rivers Huasacualco (Guasacualco) and Chimalapa from materials which I found in the archives of the viceroyalty of Mexico, and particularly from the plans of the engineers Don Miguel del Coral and Don Augustin Cramer, whom the viceroy Revillagigedo sent to the spot. The distances were rectified by itineraries very recently drawn up since the indigo of Guatimala came to pass through the forest of Tarifa, which is a new road opened to the commerce of Vera Cruz.

V. PLAN OF THE PORT OF VERA CRUZ.

This work would undoubtedly appear incomplete, if it did not contain the plan of the port from which

all the Mexican wealth flows into Europe. To this day Vera Cruz is the only port which can receive European vessels of war. The plan which I publish is an exact copy of the one drawn up in 1798 by M. Orta, captain of the port of Vera Cruz. I have diminished the scale by one half, and added a few notes on the longitude, winds, atmospheric tides, and on the quantity of rain which falls annually. The mere sight of this plan proves the difficulty of every military attack against a country, which on its eastern coast offers no other shelter to vessels than a dangerous anchorage among shallows.

The double lines drawn on the plan of the port indicate the direction which vessels intending to anchor ought to follow. Whenever the pilot discovers the edifices of Vera Cruz, he should take care that the tower of the church of St. Francis cover the tower of the cathedral. He will continue this route till the salient angle of the bastion of S. Crispin appear behind the bastion of St. Peter. He should then tack to the larboard, placing the prow towards the Isle of Sacrifices. Buoys (*palos de marca*) have been placed on the shallow of la Gallega near the point of the Soldado, to avoid the two dangerous rocks, called *Laxa de Fuera* and *de Dentro*.

VI. PHYSICAL VIEW OF THE ORIENTAL DECLIVITY OF THE TABLE LAND OF ANAHUAC.

The horizontal projections known by the name of geographical maps, give but a very imperfect idea of the inequalities of surface and physiognomy of a country. The undulations of the surface (*mouvemens du terrain*,) the form of the mountains, their relative height, and the rapidity of the declivities, can only be completely represented in vertical sections.

A map drawn up on the ingenious plan of M. Clerc* supplies to a certain degree the place of a relievo; and lines drawn on a plane which has but two dimensions may produce the same effect as a model in relievo, if the extent of ground represented is not too great, and if it is thoroughly known in all its parts. But the difficulties are almost insurmountable when the horizontal projection embraces a hilly country of a surface of several thousand square leagues.

In the most inhabited region of Europe, for example, in France, Germany, or England, the plains which are the seat of cultivation are only elevated, in general, a hundred,† or two hundred metres‡ above one another. Their absolute heights are too inconsiderable to have any sensible influence on the climate.§ Hence an accurate knowledge of these elevations is much less interesting to the cultivator than to the naturalist; and hence also, in the maps of Europe, the geographers merely indicate the most

* This learned geographical engineer, who presides over topography in the *Ecole Polytechnique*, possesses in an eminent manner the talent of representing the figure of a country. Nobody ever reflected more than he has done on the means of expressing undulations of surface, and a work which he means to publish on the construction of maps, and on the construction of *relievos*, will form an æra in the history of topography.

† About 328 feet. *Trans.*

‡ About 656 feet. *Trans.*

§ The interior of Spain presents a very striking exception; the soil of the Castiles in the environs of Madrid being six hundred metres of absolute elevation (about 1960 feet.) See my memoir on the configuration of the soil of Spain, inserted in the itinerary of M. Alexandre de Laborde. T. I. p. CXLVII. CLVI. From the data contained in that memoir, the small geological map attached to the interesting *Rapport sur l'importation des Merinos, par M. Pouferé de Céré*, 1809, was drawn up. It is to be regretted, however, that this map was not drawn up in all its parts according to the same scale of elevation.

elevated chains of mountains. But in the equinoxial region of the new continent, particularly in the kingdoms of New Grenada, Quito, and Mexico, the temperature of the atmosphere, its state of dryness or humidity, the kind of cultivation followed by the inhabitants, all depend on the enormous elevation of the planes which stretch along the ridges of the Cordilleras. The geological constitution of these countries an object equally important for the statesman and e naturalist; from whence it follows that the imrfection of our graphical methods is much more sible in a map of New Spain than in a map of nce. Hence, to give a complete idea of the couns examined by me, of which the soil possesses so raordinary a configuration, I have been compelled recur to methods hitherto unattempted by geogras, because the most simple ideas are usually those ch occur the last.

have represented whole countries, vast extents of itory in vertical projections, in the manner in ch the section of a mine or canal is drawn.* e principles on which similar physical views ht to be constructed are detailed in my Essay Geological *Pasigraphy*. As the places of which important to know the absolute height are rarely e found on the same line, the section is compoof several planes, which differ in their direction, rather of one plane, which exhibits the average llel line of direction on which the perpendiculars

In the last case the distances, exhibited by the sical map differ from the absolute distances, parlarly when the mean direction of the points whose ht and position have been determined deviates

The first attempt made by me in this way was the physical of the river *de la Madaleine*, engraved, in 1801, against vill at Madrid. See my *Recueil d'Observations Astroques*, vol. i. p. 370.

considerably from the direction of the plane of p
jection.

In sections of whole countries, as in sections
canals, the scale of distances cannot be equal to t
scale of elevations. If we were to attempt to give t
same magnitude to these scales, we should be force
either to make the drawings of an immoderate lengt
or to adopt a scale of elevation so small that the mo
remarkable inequalities of the soil would becom
insensible. I have indicated on the plate by tw
arrows the heights which the Chimborazo and t
city of Mexico would have, if the physical vie
were subjected to the same standard in all its dime
sions. We see that in this case an elevation of 50
metres* would not occupy in the drawing more tha
the space of a millimetre.† But in employing f
itinerary distances the scale of elevations exhibite
in the plates VI, VII, VIII. which is nearly 27
metres‡ to the centimetre,§ a plate would be requ
site of more than 15 metres‖ in length, to represe
the extent of country comprised between the mer
dians of Mexico and Vera Cruz! Hence from th
inequality of scales, my physical maps, as well a
the sections of canals and roads, drawn up by engi
neers, do not exhibit the true declinations of th
soil, but these declinations, according to the natur
of the projections employed, appear more rapid i
the designs than they are in nature.¶ This incor

* About 1640 feet. *Trans.*

† .03937 of an inch. *Trans.*

‡ About 885 feet. *Trans.*

§ .39371 of an inch. *Trans.*

‖ About 55 feet. *Trans.*

¶ See my *Essai sur la Géographie des Plantes*, p. 53.

venience is increased if the plains of a great elevation are of very small extent, or if they are separated by deep and narrow valleys. It is from the proportion which the scales of distance and elevation bear to one another that the effect produced by the section of a country principally depends. I shall not enter here into a minute discussion of the principles followed by me in this kind of map. Every graphical method should be subject to rules, and it appeared to me so much the more necessary to point out some of these rules in this place, as the imitations of my views recently published are arbitrary projections on planes abounding with curves, of which nothing indicates the direction in relation to the great circles of the sphere.

Physical maps in vertical projections can only be constructed on knowing, for the points through which the plan of projection passes, the three coördinates of longitude, latitude, and elevation above the level of the ocean; and it is only in uniting barometrical measurements with the results of astronomical observations, that the section of a country can be drawn. This kind of projection will become more frequent in proportion as travellers shall addict themselves more assiduously to barometrical observations. But few provinces of Europe at this day offer the necessary materials for constructing views analogous to those published by me of equinoxial America.

The construction of the sections, plates VI, VII, VIII. are absolutely uniform. The scales are the same in all the three views; the scales of distance are to those of height nearly as one to twenty-four. The three maps indicate the nature of the rocks which compose the surface of the soil. This knowledge is interesting to agriculturists; and it is also useful to engineers employed in constructing roads or canals.

I have been blamed for not exhibiting in these sections the superposition or situation of the secondary or primitive strata, their inclination or their direction. I had particular reasons for not indicating these phenomena. I possess in my itineraries all the necessary geological materials for forming what are usually called mineralogical maps. A great number of these materials were published by me in my recent work on the measurement of the Cordillera of the Andes; but on mature examination I adopted the resolution of separating entirely the geological sections which display the superposition of rocks from the physical views which indicate inequalities of surface. It is very difficult, I had almost said impossible, to construct a geological section of an extensive country, if this section must be subjected to a scale of elevation. A stratum of gypsum of one metre* thick is often more interesting to a geologist than an enormous mass of amygdaloid or porphyry; for the existence of these very slender strata, and the manner in which they lie, throw light on the relative antiquity of formations. How then shall we trace the section of entire provinces, if the magnitude of the scale is to be such as to exhibit masses so inconsiderable? How shall we indicate in a narrow valley, as that of Papagayo, for example, (Plate VII.) in a space of one† or two millimetres of breadth, which the valley occupies in the drawing, the different formations which repose on one another? Those who have reflected on graphical methods, and endeavoured to improve them, will feel, like myself, that these methods can never unite every advantage. A map, for instance, overcharged with signs, becomes confused, and loses its principal advantage, the power of conveying at once a great number of relations. The

* 39.371 inches. *Trans.*

† A millimetre contains .03937 of an inch. *Trans.*

nature of the rocks and their mutual superposition interest the geologist much more than the absolute elevation of formations and thickness of strata. It is sufficient if a geological section expresses the general aspect of the country, and it is only in freeing it from scales of height and distance that it can indicate luminously the phenomena of stratification, which it is of importance for geologists to know.

The physical view of the eastern declivity of New Spain is composed of three sections, which I have distinguished by different colours. The cities of Mexico, and la Puebla de los Angeles, and the small hamlet of Cruz Blanca, situated between Perote and las Vigas, are the points in which the intersection of the three planes of projection is made. I have added the longitude and latitude of these points, the medium direction of each section, and its length in French leagues of twenty-five to the degree.

The two great volcanoes on the east of the valley of Tenochtitlan, the Pic d'Orizaba, and the Cofre de Perote, were placed in the drawing according to their true longitudes. We have represented them as they appear when a thick fog covers their base, and when their summits are seen above the clouds. Notwithstanding the enormous breadth of these colossal mountains, we have not dared to represent their whole contours, on account of the great inequality of the scales of height and distance. These volcanoes would have disfigured the view, rising like so many slender columns above the plain. I have endeavoured to represent very exactly the strange form, I had almost said the particular physiognomy, of the four great mountains of the Cordillera of Anahuac; and I flatter myself that those who travelled from Vera Cruz to Mexico, and who have been struck with the wonderful aspect of these majestic mountains, will perceive that the contours are exhibited with precision in this plate, and in No. IX. and X.

That the reader may fix in his mind some important facts of physical geography, we have marked on the two sides of the views, near the scales of elevation, the height of the Chimborazo, and of several mountains of the Alps and Pyrenees; that of the limit of perpetual snows under the equator, under the parallel of Quito, and the 45° of latitude; the middle temperature of the air at the foot and on the slope of the Cordilleras; and, lastly, the elevations at which certain Mexican plants begin to be seen, or cease to vegetate in the mountainous part of the country. Several of these phenomena are even repeated in all the maps; a repetition analogous to what is in the thermometer scales formerly exhibited, which indicated, though very inaccurately, the maximum and minimum of temperature observed under such or such a zone. I believed that these sections, which have some analogy with the large view in my Geography of Plants, might perhaps contribute to propagate the study of the natural history of the globe.

VII. PHYSICAL VIEW OF THE WESTERN DECLIVITY OF THE TABLE-LAND OF NEW SPAIN.

This and the preceding view, and the section of the valley of Tenochtitlan, (plate VIII.) are drawn up all three according to the principles laid down by me in discussing the section of the eastern slope of the Cordilleras. I have framed on the same scale plates VII. and VIII. that they may all be united at pleasure into one, which will then extend from the Atlantic Ocean to the South Sea, and which will develop to the geologist the extraordinary conformation of the whole country.

It may be necessary to observe to those who wish to unite the sections VII. and VIII. in cutting the two vertical scales on which the heights of Puy-de

Dôme and Vesuvius are marked, that the planes of projection of these sections intersect each other almost at right angles, in the centre of the city of Mexico. The medium direction of the first section, which is itself composed of different planes, is from east to west; the medium direction of the second, the road from Mexico to Acapulco, is from S. S. W. to N. N. W. The prolongation of the first section would extend nearly by Pascuaro and Zapotlan, to the Villa de la Purificacion. This plane prolonged to the west would terminate on the shores of the South Sea, between Cape Corrientes, and the port de la Navidad. As New Spain swells out singularly in this western direction, it would follow that the descent of the Cordillera, from the valley of Tenochtitlan to the plains of the intendancy of Guadalaxara, would be twice the length of the road from Mexico to Acapulco, sketched in plate VII. The barometrical measurements which I made between Valladolid, Pascuaro, Ario, and Ocambaro, prove, that in tracing this transversal section in the direction of the parallels of 19 or 20 degrees, the central plain would preserve the great elevation of 2,000* metres for more than sixty leagues to the west of the city of Mexico, while, in the direction of the section, No. VII. the plane never reaches this elevation, after leaving the valley of Tenochtitlan towards the S. S. W.

Yet a section directed from east to west, from Vera Cruz to the small port de la Navidad, is far from giving a juster idea of the geological constitution of New Spain than the reunion of my two sections, No. VII. and VIII. A simple consideration of the true direction of the Cordillera of Anahuac is sufficient to prove what I advance. The central chain of the mountains runs from the province of Oaxaca to that of Durango, from the S. E. to the N.

* 6,560 feet. *Trans.*

W.; consequently, the plane of projection, to be perpendicular to the longitudinal axis of the Cordillera, should not be placed parallel to the equator, but drawn from the N. E. to the S. W. By reflecting on the particular structure and limits of the group of mountains, in the neighbourhood of the capital of Mexico, we shall find that the reunion of the two sections, No. VII. and VIII. gives a less imperfect representation of the conformation of the country, than we should be tempted to believe from purely theoretical ideas. In this mountainous region between the 19° and 20° of latitude, nothing announces a longitudinal crest. There are none of those parallel chains which geologists always admit in their works, and which geographers represent in the most arbitrary manner, in their maps of the two continents, like ranges of elevated dikes. The Cordillera of Anahuac increases towards the north, from whence the inclined planes formed by the eastern and western declivities are not parallel to one another in their middle direction. This direction is almost N. and S. along the coast of the gulf of Mexico, while it is S. E. and N. W. in the declivity opposite the Great Ocean. Hence the sections, to be perpendicular to the lines of declivity, cannot be in the same plane of projection.

VIII. PHYSICAL VIEW OF THE CENTRAL TABLE-LAND OF NEW SPAIN.

The section of the road leading from Mexico to the mines of Guanaxuato, the richest of the known world, was drawn up under my eye at Mexico, by M. Raphael Davalos,* a pupil of the school of mines,

* M. Davalos, as well as M. Juan Jose Rodriguez, a native of the Parral, in the *provincias internas*, and well informed in

and a very zealous young man. This drawing displays to the naturalist the great elevation of the table-land of Anahuac, which extends to the north much beyond the torrid zone. The extraordinary configuration of the Mexican soil recalls the elevated plains of central Asia. It would be interesting to continue my section from Guanaxuato to Durango and Chihuhua, particularly to Santa Fe in New Mexico. For the table-land of Anahuac, as we shall hereafter prove,* preserves towards the north for an extent of more than two hundred leagues more than 2,000,† and for an extent of five hundred leagues more than 800‡ metres of absolute elevation.

IX. PICTURESQUE VIEW OF THE VOLCANOES OF MEXICO OR LA PUEBLA.

This plate and the immediately following one were destined at first to appear in the physical atlas, which will accompany the historical account of my travels in the equinoxial regions. I mean to unite in that atlas such sketches as will show the physiognomy of the collossal summits which crown the ridge of the Cordilleras, and form as it were their crest. I thought that these contours, compared with those in the excellent itinerary of M. Ebel, or the beautiful drawings of M. Osterwald, might prove interesting to the geologists who wish to study comparatively the Alps

physical science, were so good as to assist me for several months in the construction of a great number of geological maps which will be afterwards published. I am pleased to have an opportunity of giving a public testimony of my gratitude to gentlemen so distinguished for their talents and application.

* Book I. and book III.

† 6,560 feet. *Trans.* ‡ 2,624 feet. *Trans.*

of Switzerland, and the Andes of Mexico and Peru. Though the object of the work which I now publish is more to describe the territorial riches than the geological constitution of New Spain, I have thought proper to add to the Mexican atlas the picturesque views No IX. and X. to serve as a supplement to the map of the valley, (plate III.) and to give a more lively idea of the beauty of the situation of the city of Mexico. These same summits, the Popocatepetl and the Citlaltepetl, the first of which is visible at Mexico and Cholula, and the second at Cholula and Vera Cruz, served me to verify the meridian difference of the city of Mexico and the port of Vera Cruz by a method very advantageous, but hitherto little followed; that of perpendicular bases, azimuths and angles of altitude.*

The city of Mexico is nearer by one half to the two *Nevados de la Puebla* than the cities of Bern and Milan are to the central chain of the Alps. This great proximity contributes much to give an awful and majestic aspect to the Mexican volcanoes. The contours of their summits, covered with eternal snow, appear so much the more marked, as the air through which the eye receives the rays is more rare and transparent. The snow is of a most extraordinary brilliancy, particularly when it descends from a sky of which the blue is always deeper than that of the sky which we see from our plains of the temperate zone. The observer finds himself, in the city of Mexico, in a stratum of air, whose barometrical pressure is only 585 millimetres.† It is easy to conceive, that the extinction of light must be very trifling in an atmosphere so little condensed, and that the summit of the Chimborazo, or the Popocatepetl,

* See above, p. xxiii. and my *Recueil d'Observations Astronomiques*, vol. I. p. 373.

† Nearly twenty-three inches. *Trans.*

seen from the plains of Riobamba or Mexico, must exhibit more distinct contours than if they were seen at the same distance from the shores of the ocean.

The *Iztaccihuatl* and the *Popocatepetl*, of which the latter has the conical form peculiar to the Cotopaxi and the Pic d'Orizaba, are called indiscriminately in the country the volcanoes of la Puebla or Mexico, because they are equally well distinguished from these two cities. I have no doubt that the Iztaccihuatl, which Cardinal Lorenzana calls *Zihualtepec*, is an extinguished volcano; but no Indian tradition goes back to the time when this mountain, which in its contours resembles the volcano of Pichincha, vomited forth fire. The same observation applies to the *Nevado de Toluca*. The Spaniards have been in the habit, from the first times of the conquest, of naming every insulated summit *volcan*, which enters into the region of perpetual snow. The words *nevado* and *volcan* are frequently confounded: I have even heard at Quito, the strange expressions *volcan de nieve* and *volcan de fuego*.* The Cotopaxi, for example, is reputed a *fire-volcano*, because its periodical eruptions are known, while the Corazon and the Chimborazo are called *snow-volcanoes*, because the natives suppose that the fire is concealed in them. In the kingdom of Guatimala,† and in the Philippine Islands, they call *water-volcanoes* (*volcanes de agua*) those which inundate the surrounding country. From these examples, we may see that the word *volcan*, in Spanish maps, is frequently used in a sense quite different from what is understood by it among the other nations of Europe.

M. Don Luis Martin drew the volcanoes of la Puebla as they appear in a clear day from the Terrace of

*Snow-volcano and fire-volcano. *Trans.*

† "En Goatemala hay dos volcanos, uno de fuego y otro de agua." (*Lorenzana*, in a note to the Letters of Cortez.)

the School of Mines; (*Seminario Real de Mineria*). . justly celebrated artist, who honours me with a parti cular friendship, M. Gmelin of Rome, was obligin enough to retouch the drawing of M. Martin, an my sketch of the Pic d'Orizaba. The contou were nowise altered, and I have no doubt that th hand of a great master will easily be perceived i the distribution of shade, as well as in the effect o the chiaro-scuro.

It may be useful to observe, that the volcanoes o la Puebla were drawn in the month of January, i a season when the inferior limit of perpetual sno almost descended to the height of the summit of th Peak of Teneriffe, or to 3,800 metres of absolut elevation.* During my stay at Mexico, I saw suc immense falls of snow in the mountains, that the tw volcanoes were almost united by one band of snow The maximum† of elevation of the region of snow which I found in the month of November, 1803, wa nearly 4,560 metres.‡

The Sierra Nevada, or Iztaccihuatl, is only a few metres higher than Mount Blanc; but the Popoca tepetl surpasses Mount Blanc 625 metres§ in height Besides, the plain which extends from the city o Mexico to the foot of the volcanoes is itself mor elevated than the summit of Mount d'Or, and th famous passages of the lesser St. Bernard, Moun Cenis, Simplon, and the ports of Gavarnie an Cavarere.

It was between these two volcanoes of la Puebl that Cortez passed with his troop and six thousan Tlascaltecs, on his first expedition against the city o

* About 12,460 feet. *Trans.*

† See book i. chap. ii.

‡ 14,956 feet. *Trans.*

§ 2,050 feet. *Trans.*

Mexico. During this severe march, the valorous Diego Ordaz, to give the natives a proof of his courage, attempted to reach the summit of the Popocatepetl. Though he did not succeed in his undertaking,* the emperor Charles V. gave him permission to enter a volcano in his coat of arms. I will not now agitate the question which is so often the subject of dispute at Mexico, namely, whether Francisco Montano, after the taking of the capital, in 1552, drew the sulphur employed in the fabrication of powder from the crater of Popocatepetl, or from some lateral crevice.

X. PICTURESQUE VIEW OF THE PIC D'ORIZABA.

The Pic d'Orizaba, on the position of which Mr. Arrowsmith and other geographers have thrown so much confusion in their maps, is as celebrated among navigators as the Pic of Teneriffe, the Silla of Caraccas, the Table Mountain, or the Pic S. Elie. I have drawn it as it appears in the road from Xalappa to the village of Oatepec (Huatepeque) near the Barro de Santiago. From this station nothing is discovered but the part which is covered with perpetual snow. The first plane of my drawing is a thick forest of liquid-amber styraciflua, melastomes, strawberry trees, and pipers. It is very remarkable that the two largest Mexican volcanoes, the Popocatepetl and Citlaltepetl, have both the crater inclined to the south-east. We find in general, that in the equinoxial region of New Spain the mountains decline most rapidly towards the gulf of Mexico, and that the ridges of rocks are most frequently directed from

* *Cartas de Cortez*, p. 318. and 380. *Clavigero*, III. p. 68. and 162.

the N. W. to the S. E. For the better distinction of active from extinguished volcanoes, I have ventured to add a small column of smoke to the drawings of the Pic d'Orizaba and the great volcano of Puebla, though I never observed any smoke either from Xalappa or Mexico. M. Bompland and myself saw a mass of ashes and very dense vapours issue from the mouth of the Popocatepetl on the 24th January, 1804, in the plain of Tetimpa, near San Nicholas de los Ranchos, where we made a geodæsical survey of the volcano. The Pic d'Orizaba, called also by the Indians *Pojauhtecatl* or *Zeuctepetl*, had its strongest eruptions between 1545 and 1566.

Eight years before my arrival at Mexico M. Ferrer measured the Citlaltepetl, in taking angles of altitude at a great distance from the summit of the volcano, near l'Encero. He gives it, in a memoir inserted in the transactions of the society of Philadelphia, the height of 5,450 metres.* My measurement makes it 155 metres† lower. This measurement was taken in a small plain near Xalappa, where the angle of elevation of the summit is only 3° 43′ 48″. However, notwithstanding the extraordinary constancy of refractions in the tropics, and notwithstanding all the care which I took during the whole course of the expedition, I do not entertain the belief that I have been able to ascertain the height of a single American mountain, as accurately as the height of several mountains of Europe were ascertained by the geodæsical operations of MM. Tralles, Delambre, Zach and Oriani. It is with these delicate operations, as with the chemical analysis of minerals; they are never executed with great precision, but when we enjoy complete tranquillity, and the leisure which a traveller can seldom find in distant climates.

* 17,876 feet. *Trans.* † 508 feet. *Trans.*

XI. PLAN OF THE PORT OF ACAPULCO.

The commerce of New Spain has but two openings, the ports of Vera Cruz and Acapulco. By the former the commerce is carried on with Europe, the coast of Caraccas, the Havannah, the United States, and Jamaica. The latter is the central point of the South Sea and Asiatic commerce. It receives the vessels which come from the Philippine Islands, Peru, Guayaquil, Panama, and the north-west coast of North America.

It would be difficult to find two harbours which exhibit so great a contrast. The port of Acapulco appears an immense basin, dug by the hand of man, while the port of Vera Cruz does not even deserve the name of road. It is a disagreeable anchorage among shallows.

The plan which I now give of the port of Acapulco was never published, though many copies of it exist in America. It was taken in 1791, by the officers embarked with Malaspina, in the corvettes Descubierta and Atrevida. I suppose that the drawing was executed in the *Deposito Hydrografico* of Madrid. This drawing agrees very well with another plan of Malaspina, of more than a metre* in length, which I examined at Acapulco while I was there in 1803.

The longitude which I assign to the port of Acapulco is greater than what is adopted in the *Voyage of la Sutil and Mexicana to the Straits of Fuca*. But according to a posterior memoir inserted in the almanack of Cadiz, the astronomers of the *Deposito Hydrografico* of Madrid now adopt a position for Acapulco much more western than mine. It is the same

* 39.371 inches. *Trans.*

with what my chronometer gave, on reducing Acapulco to Mexico, and neglecting the lunar distances observed on the 27th and 28th of March, 1803.

M. Espinosa found Acapulco west from Paris, by transference of time from the port of San Blas,* 102° 17′ 21″; by two satellites of Jupiter, observed simultaneously at Greenwich and Paris, 102° 24′ 15″; and by eight satellites compared with the corrected tables, 102° 15′ 47″; the mean term of which is 102° 19′ 8″, the longitude adopted by M. Antillon in the analysis of the map of America. There were observed besides during the stay of Malaspina's expedition at Acapulco, in 1791, two stellar eclipses, for which there were however no corresponding observations in Europe. Captain Don Juan Tiscar calculated them from the tables of Bürg. He found Acapulco, by the eclipse of the 19th February, 102° 9′ 45″, and by the eclipse of the 15th April, 102° 35′ 45″. Distances of the moon from the sun, taken the 12th February, but calculated by groups, and without correcting the situation of the moon by the observation of a passage to the meridian, gave 102° 24′ 37″.

Here are a great number of determinations by very different means! All of them give a longitude *somewhat more western* than the result of my own observations, which I adopted before I had any know-

* It must be remarked, that the longitude of San Blas is only founded on two celestial observations, a satellite compared with the tables, and a lunar eclipse. The results of these two observations differ in an arc of 5′ 45″. The memoir of M. Espinosa affords an instructive example of the extreme prudence requisite in the use of the chronometer, if the chronometrical longitudes be not verified by other observations purely celestial. In Malaspina's expedition, four of *Arnold's* chronometers gave to port Mulgrave, to within 9′, the same longitude of 142° 38′ 57″; and yet it has been proved by lunar distances that the true longitude is 142° 0′ 27″. The four chronometers had all changed their diurnal motion at the same time.

GEO. W. CLARK
MEXICO
THE TWO REPUBLICS

ledge of the interesting memoir of M. Espinosa. Stellar eclipses are certainly preferable to every other species of observation, if they are conducted under favourable circumstances. But the results of the eclipses of the two stars observed at Acapulco differ from one another, according to the calculation of M. Tiscar, 26′, and according to M. Oltmanns in an arc of 5′. The Spanish astronomers admit a very great error of the tables for the first satellite. They make it 35″ in time, while M. Oltmanns, on comparing the tables of Delambre with observations from the month of January to the month of May, 1791, finds the error of the tables only —7″, 6 for the immersions, and —14″ for the emersions. He believes, agreeably to the calculations published in the second volume of our collection of astronomical observations, that the true mean term of the observations of Malaspina's expedition is 102° 14′ 30″, and that by merely allowing half the value to our observations, we might fix the longitude of Acapulco at 102° 9′ 33″: that is to say, that it would be three minutes and a half further west than is indicated in my map. We ought not to be astonished at these doubts which remain as to the position of a port of the South Sea, when we consider that the longitude of Amsterdam was uncertain till a few years ago, not for three or four minutes, but the third part of a degree.

XII. MAP OF THE DIFFERENT ROUTES BY WHICH THE PRECIOUS METALS FLOW FROM ONE CONTINENT INTO THE OTHER.

The quantity of gold and silver annually sent by the New Continent into Europe amounts to more than nine-tenths of the produce of the whole mines in the known world. The Spanish colonies, for example, furnish annually three millions and a half of marcs of

silver,* while in the whole of the European state including Asiatic Russia, the total annual produce the mines scarcely exceeds† the sum of three hun dred thousand marcs.‡ A long stay in Spanish Ame rica enabled me to procure more exact information with respect to the metallic wealth of Mexico, Peru New Grenada, and the viceroyalty of Buenos Ayres than is to be found in the works of Adam Smith, Ro bertson, or Raynal. From thence I might naturally have entered into an investigation of the accumula tion of the precious metals in the south and south east of Asia; but a problem so important as this ma constitute the subject of a particular memoir. I hav thought proper to exhibit here the principal results o my researches, in a small map sketched at sea in 1804 on my passage from Philadelphia to France. This map indicates the flux and reflux of the precious me tals. We observe in general that they move from west to east; a motion the reverse of that of th ocean, atmosphere, and the civilization of our species

XIII. FIGURES REPRESENTING THE SURFACE OF NEW SPAIN, AND OF ITS INTENDANCIES, THE PROGRESS OF MINING, AND OTHER OBJECTS RELATIVE TO THE EUROPEAN COLONIES IN THE TWO INDIES.

The collected figures in this plate serve to explain what is afterwards said§ on the extraordinary disproportion between the extent of the colonies and the surface (*area*) of the European mother countries

* 2,370,046 Troy pounds. *Trans.*

† See, as to the mines of Europe, the excellent statistical table of the produce of mines annexed to the *Mémoire Général sur les Mines, par M. Heron de Villefosse*, p. 240. (Paris 1809, *chez Fr. Schoell.*)

‡ 203,130 pounds Troy. *Trans.*

§ Chapter I. and chapter VIII.

The inequality of the territorial division of New Spain has been rendered sensible in representing the intendancies by squares inscribed above one another. This graphical method is analogous to what M. Playfair first employed, in a very ingenious manner, in his commercial and political atlas, and in his statistical maps of Europe. Without attaching much importance to these sketches, I cannot regard them as mere trifles foreign to science. It is true the map which M. Playfair gives of the national debt of England brings to mind the section of the Pic of Teneriffe; but natural philosophers have long indicated by similar figures the state of the barometer and mean temperature of months. It would be ridiculous to endeavour to express by curves, moral ideas, the prosperity of nations, or decay of their literature; but whatever relates to extent and quantity may be represented by geometrical figures; and statistical projections which speak to the senses without fatiguing the mind, possess the advantage of fixing the attention on a great number of important facts.

TABLE

Of the geographical positions of the kingdom of New Spain, determined by astronomical observations.

(The positions, marked with an asterisk, are established either by triangulations, or angles of altitude and azimuths.)

Names of places.	N. Latitude.	Long. W. from Paris. In degrees.	Long. W. from Paris. In time.	Names of observers and remarks.
INTERIOR OF NEW SPAIN.				
Mexico	19° 25′ 45″	101° 25′ 30″	6h 45′ 42″	Humboldt, at the convent of St. Augustin.
S. Augustin de las Cuevas, (village)	19 18 37	101 27 0	6 45 48	idem.
Cerro de Axusco,* (mountain)	19 15 17	101 32 45	6 46 11	idem.
Venta de Chalco, (farm)	19 16 8	.. .. ..	.. .. ..	idem.
Moran, (mine)	20 10 4	100 46 0	6 43 4	idem.
Actopan, (village)	20 17 28	101 9 15	6 44 37	idem.
Totonilco el Grande, (village)	20 17 55	100 53 0	6 43 32	idem.
Tisajuca, (village)	.. .. ..	101 11 30	6 44 46	idem.
Toluca, (village)	19 16 19	101 41 45	6 46 47	idem.
Nevado de Toluca	19 11 33	101 45 38	6 47 21·2	idem.
San Juan del Rio, (city)	.. .. ..	102 12 30	6 48 50	idem.
Queretaro, (city)	20 36 39	102 30 30	6 50 2	idem.
Salamanca, (city)	20 40	103 15 0	6 53 0	idem.

Names of places.	N. Latitude.	Long. W. from Paris. In degrees.	In time.	Names of observers and remarks.
Guanaxuato, (city)	21° 0′ 15″	103° 15′ 0″	6h 53′ 0″	Humboldt, at the house of Don Diego Rul.
Valladolid, (city)	19 42 0	103 12 15	6 52 49	idem, at the bishop's palace.
Patzquaro, (city)	.. .. ..	103 40 0	6 54 40	idem.
Las Plajas de Jorullo, (farm)	.. .. ..	103 20 30	6 53 22	idem.
Volcan de Jorullo*	.. .. ..	103 21 45	6 53 27	idem.
Pont d'Istla, (farm)	18 37 41	101 34 45	6 46 19	idem.
Tehuilotepec, (village)	.. .. ..	101 48 0	6 47 12	idem, near the water-spout machine.
Tasco, (city)	18 35 0	101 49 0	6 47 16	idem.
Tepecuacuilco, (village)	18 20 0	101 48 0	6 47 12	idem.
Puente de Estola, (inn)	.. .. ..	101 44 0	6 46 56	idem.
Mescala, (village)	17 56 4	101 49 0	6 47 16	idem.
Popocatepetl,* (volcano)	18 35 47	100 53 15	6 43 33	idem, summit of the mountain.
San Nicolas de los Ranchos, (village)	19 2 0	100 41 0	6 42 44	idem.
Itztaccihuatl,* (mountain)	19 10 0	100 55 0	6 43 40	idem.
Pyramide de Cholula, (ancient monument)	19 2 6	100 33 30	6 42 14	idem.
La Puebla de los Angeles, (city)	19 0 15	100 22 45	6 41 31	idem.
Venta de Sotto, (farm)	19 26 30	.. .. ..	.. .. ..	idem.

Names of places.	N. Latitude.	Long. W. from Paris. In degrees.	Long. W. from Paris. In time.	Names of observers and remarks.
Perote, (village	19° 33′ 37″	99° 33′ 45″	6h 38′ 15″	Humboldt.
Cofre de Perote (mountain)	19 28 57	99 28 45	6 37 55	idem.
Las Vigas, (village)	19 37 37	.. .. ..	.. .. ..	idem.
Xalappa, (city)	19 30 8	99 15 0	6 37 0	idem.
Cerro de Macultepec, (mountain)	19 31 49	99 14 35	6 36 58	idem.
Pic d'Orizaba,* (volcano)	19 2 17	99 35 15	6 38 21	Humboldt and Ferrer, summit of the mountain.
El Encero, (farm)	19 28 25	99 8 32	6 36 34	Ferrer.
Tezcuco,* (city)	19 30 40	101 11 15	6 44 45	Velasquez.
Zumpango,* (village)	19 46 52	101 24 0	6 45 36	idem.
El Penol,* (hill)	19 26 4	101 22 30	6 45 30	idem.
Xaltocan,* (village)	19 42 47	101 21 15	6 45 25	idem.
Tchuiloyuca,* (village)	19 43 17	101 28 5	6 45 54	idem.
Hacienda de Xalpa,* (farm)	19 47 58	101 29 45	6 45 59	idem.
Cerro de Chiconautla,* (hill)	19 38 39	101 16 0	6 45 4	idem.
San Miguel de Guadalupe,* (convent)	19 28 48	101 24 45	6 45 39	idem.
Huchuetoca,* (village)	19 48 38	101 32 45	6 46 11	idem.
Garita de Guadalupe,* (barrier)	19 28 38	101 24 45	6 45 39	idem.
Cerro de Sincoque,* (hill)	19 28	101 33 30	6 46 14	idem.
Hacienda de Santa Ines,* (farm)	19 49 25	101 24 15	6 45 37	idem.

Names of places.	N. Latitude.	Long. W. from Paris. In degrees.	In time.	Names of observers and remarks.
Cerro de San Christoval,* (mountain)	19° 35′ 5″	101° 21′ 30″	6h 45′ 26″	Velasquez.
Puente del Salto,* (bridge)	19 54 30	101 36 0	6 46 24	idem.
EASTERN COAST OF NEW SPAIN.				
Campeche, (city)	19 50 45	92 50 45	6 11 23	Ferrer and Cevallos.
Punta de la Disconocida	20 49 45	92 44 30	6 10 58	Cevallos and Herrera.
Castillo del Sisal	21 10 0	92 19 45	6 9 19	idem.
Alacran, (western point)	22 27 50	92 7 40	6 8 30	idem.
Alacran (northern extremity)	22 35 15	92 0 45	6 8 3	idem.
Mouth of the Rio de los Lagartos	21 34 0	90 30 15	6 2 1	idem.
Punta S. O. del Puerto	22 21 30	91 58 15	6 7 57	idem.
North point of the Conboy	21 33 30	89 5 0	6 56 20	idem.
South point of the Conboy	21 28 50	89 4 0	6 56 16	idem.
Baxo del Alerta	21 33 0	89 11 15	6 56 45	idem.
Shallow of Diez Brazas	20 32 10	94 14 5	6 15 56	idem.
Small island to the S. W. of the triangle	20 55 50	94 31 52	6 18 7 1-2	idem.
Baxo del Obispo	20 30 14	94 30 23	6 18 1 1-2	idem.
Vera Cruz, (port)	19 11 52	98 29 0	6 33 56	Humboldt and Ferrer.
Island of Sacrifices, (centre)	19 10 10	98 26 40	6 33 47	Ferrer.
Shallow of the Pajaro	19 10 55	98 26 10	6 33 45	idem.
Isla Verde	19 11 16	98 25 26	6 33 42	idem.
Islote Blanquillas, (centre)	19 12 55	98 26 45	6 33 47	idem.

Names of places.	N. Latitude.			Long. W. from Paris. In degrees.			In time.			Names of observers and remarks.
Anegada de Fuera, (south point)	19°	12′	12″	98°	24′	35″	6h	33′	38″	Ferrer.
——————, (north point)	19	12	55	98	25	5	6	33	40	idem.
Gallega Shallow	19	13	20	98	28	22	6	33	53 1-2	idem.
Punta Gorda	19	14	30	98	31	20	6	34	5	idem.
Mouths of the Rio Antigua	19	18	41	98	37	17	6	34	29	idem.
Bernal Chico	19	37	45	98	46	5	6	35	4	idem.
Bernal Grande	19	39	42	98	45	43	6	35	3	idem.
Punta Mari Andrea	19	43	15	98	45	43	6	35	3	idem.
Barra de Tamiagua	21	15	48	..	..	..	..	..	..	idem.
Santander, (city)	23	45	18	100	32	23	6	42	91-2	idem.
Lago de San Fernando, or la Carbonera	24	36	0	100	18	40	6	41	15	idem.
Mouth of the Rio Bravo del Norte	25	55	0	99	51	10	6	39	25	idem.
WESTERN COAST OF NEW SPAIN.										
Acapulco, (port)	16	50	29	102	6	0	6	48	24	Humboldt, at the governor's house.
Western extremity of las Playas deCujuca	17	15	0	103	5	15	6	52	21	Expedition of Malaspina.
Morro Petatlan, (hill)	17	32	0	103	48	45	6	55	15	idem.
Port de Selagu, (a little doubtful)	19	6	0	106	53	5	7	7	32	idem.
Cabo Corrientes	20	25	30	107	59	0	7	11	56	idem.
Small island to the N. N. W. of Cape Corrientes	20	45	0	108	7	15	7	12	29	idem.

Names of places.	N. Latitude.	Long. W. from Paris: In degrees.	In time.	Names of observers and remarks.
Cerro del Valle, (hill)	21° 1′ 30″	109° 35′ 0″	7h 18′ 20″	Expedition of Malaspina.
Iles Marias, (Cape south of the most eastern)	21 16 0	108 37 45	7 14 31	idem.
Mountain of San Juan	21 26 15	107 23 0	7 9 32	idem.
San Blas, (port)	21 32 48	107 37 45	7 10 31	idem.
Piedra Blanca	21 33 0	107 47 45	7 11 11	idem.
Isle San Juanico	21 45 30	109 1 35	7 16 6	idem.
Islote Isabella	21 50 30	108 17 5	7 13 8	idem.
Cape San Lucas	22 52 23	112 13 15	7 28 53	idem.
Mission de S. Josef, (village)	23 3 25	112 3 25	7 28 14	idem.
Mission de Todos los Santos	23 26 0	112 38 15	7 30 33	idem.
Mountain of San Lazaro	24 47 0	114 41 15	7 38 5	idem.
Mountain to the north of the Abreojos	26 59 30	116 8 15	7 44 33	idem.
Island of Cedars, (south point)	28 2 10	117 43 15	7 50 33	idem.
Isla de San Benito, (the highest part)	28 18 22	118 6 15	7 52 25	idem.
Isla Guadalupe, (Cape south)	28 53 0	120 37 15	8 2 29	idem.
Isla de San Bernardo	29 40 40	118 17 15	7 53 9	idem.
Isla de S. Martin, or de los Coronados, (the largest and most eastern islot)	32 25 10	119 38 55	7 58 36	idem.
San Diego, (port)	32 39 30	119 38 15	7 58 33	Vancouver and Malaspina.
Isla S. Salvador, (south point)	32 42 0	120 50 15	8 3 21	Expedition of Malaspina.

Names of places.	N. Latitude.	Long. W. from Paris. In degrees.	Long. W. from Paris. In time.	Names of observers and remarks.
Isla San Nicolas, (west cape) -	33° 16′ 30″	121° 56′ 15	8h 7′ 45″	Expedition of Malaspina.
San Juan, (mission) -	33 29 0	120 13 30	8 0 54	Vancouver and Malaspina.
Isla de Juan Rodriguez Cabrillo, (west cape) - - -	34 0 0	122 51 15	8 11 25	Expedition of Malaspina.
Santa Buenaventura -	34 17 0	121 45 30	8 7 2	Vancouver.
Presidio de Santa Barbara, (mission)	34 26 0	122 5 30	8 8 22	Vancouver and Malaspina.
Monterey, (Presidio) - -	36 36 0	124 11 8	8 16 44 1-2	Expedition of Malaspina.
Punta del Ano Nuevo -	37 9 15	124 42 53	8 18 51 1-2	idem.
Farallones, (rocks) - -	37 48 10	125 21 15	8 21 25	idem.
San Francisco, (port) -	37 48 30	134 57 0	8 19 48	Vancouver and Malaspina.
Cape Mendocino - -	40 29 0	126 48 45	8 27 15	Expedition of Malaspina.
Nutka, (port) - - -	49 35 13	128 55 15	8 35 41	idem. (This position and the preceding are beyond the actual bounds of New Spain.)
REVILLAGIGEDO ISLANDS.				
Isla de Santa Rosa, (centre) -	18 37 0	116 23 45	7 54 33	Collnet, Camacho, and Torres, (memoire of M. Espinosa.)
Isla del Socorro, (summit of the mountain, which is more than 1,115 metres high, or 3,657 feet) -	18 48 0	112 29 15	7 29 57	idem.
Rocca Partida - -	19 4 0	113 25 45	7 33 43	idem.
Isla de San Benedito, (south cape)	19 15 40	113 13 45	7 28 55	idem.

POSITIONS LESS CERTAIN.

Names of places.	N. Latitude.	Long. W. from Paris. In degrees.	In time.	Names of observers and remarks.
Guatulco, (port)	15° 44′ 0″	. . .	. . .	Pedro de Laguna.
Barra de Manialtepec	15 47 0	. . .	. . .	idem.
Pachutla, (village)	15 50 0	. . .	. . .	idem.
Xamiltepec, (village)	16 7 0	. . .	. . .	idem.
Guiechapa, (village)	15 25 0	. . .	. . .	idem.
Ometepec, (village)	16 37 0	. . .	. . .	idem.
Nochistlan, (village)	17 16 0	. . .	. . .	idem.
Teposcolula	17 18 0	. . .	. . .	idem.
San Antonio de los Cues, (village)	18 3 0	. . .	. . .	idem.
Guadalaxara, (city)	21 9 0	105° 22′ 30″	7h 1′ 30″	Mascaro and Rivera.
Zacatecas, (city)	23 0 0	103 55 0	6 55 40	Count de la Laguna.
Real del Rosario, (mine)	23 30 0	108 26 30	7 13 46	Mascaro and Rivera.
Durango, (city)	24 25 0	105 55 0	7 3 40	Oteyza.
Presidio del Passage	25 28 0	105 33 30	7 2 14	Mascaro and Rivera.
Villa del Fuerte	26 50 0	110 33 30	7 22 14	idem.
Real del los Alamos, (mine)	27 8 0	111 23 30	7 25 34	idem.
Presidio de Buenavista	27 45 0	112 28 30	7 29 45	idem.
Chihuahua, (city)	28 50 0	106 50 0	7 7 40	Mascaro and Lafora.

Names of places.	N.Latitude.	Long. W. from Paris. In degrees.	Long. W. from Paris. In time.	Names of observers and remarks.
Arispe, (city) - - -	30° 36′ 0″	111° 18′ 30″	7h 25′ 14″	Mascaro and Rivera.
Presidio de Janos - -	.. .. ..	109 5 30	7 16 22	Mascaro.
Presidio del Altar - -	31 2 0	114 6 0	7 36 24	Mascaro and Rivera.
Passo del Norte, (Presidio) -	32 9 0	107 3 0	7 8 12	Mascaro.
Junction of the Rio Gila and Colorado	32 45 0	.. .. ..	.. .. ..	Fathers Diaz and Font.
Las Casas grandes, (near Rio Gila)	33 30 0	.. .. ..	.. .. ..	Father Font.
Santa Fe, (city) - -	36 12 0	107 13 0	7 8 52	Lafora.

TABLE

Of the most remarkable elevations measured in the interior of New Spain.

The work published with the title of *Nivellement Barometrique fait dans les Regions Equinoxiales du Nouveau Continent*, in 1799—1804, contains more than two hundred points in the interior of New Spain, of which I determined the elevation above the level of the sea, either by the barometer, or by trigonometrical methods. We have merely inserted in the following table the absolute heights of the most remarkable mountains and cities. The points marked with an asterisk are doubtful. My *Recueil d'Observations Astronomiques et de Mesures Barometriques*, edited by M. Oltmanns, may also be consulted, (vol. I. pages 318 to 334.)

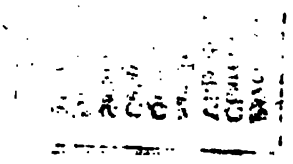
Names of places of observation.	Height above the level of the sea, according to the formula of M. Laplace.		
	In metres.	In toises.	In Eng. feet †
Volcan de Popocatepetl, volcan grande de Mexico ò de Puebla	5400	2771	17716
Pic d'Orizaba or Citlaltepetl	5295	2717	17371
Nevado d'Iztaccihuatl, Sierra Nevada of Mexico	4786	2456	15700
Nevado de Toluca, at the rock of Frailes	4621	2372	15159
Cofre de Perote, or Nauhcampatepetl	4089	2098	13514
Cerro de Axusco, six leagues to the S. S. W. of Mexico	3674*	1885*	12052

† This column is added by the translator.

Names of places of observation.	Height above the level of the sea, according to the formula of M. Laplace.		
	In metres.	In toises.	In Eng. feet.
Pic de Tancitaro	3200*	1642	10498
El Jacal, summit of the Cerro de las Nabajas	3124	1603	10249
Mamanchota or Organos d'Actopan, N. E. from Mexico	2977	1527	9766
Volcan de Colima	2800*	1437	9186
Volcan de Jorullo, in the intendancy of Valladolid	1301	667	4267
Mexico, at the convent of St. Augustin	2277	1168	7470
Pachuca	2484	1274	8149
Moran, mine near the Real del Monte	2595	1331	8513
Real del Monte, mine	2781	1427	9057
Tula, city	2053	1053	6735
Toluca, city	2688	1379	8818
Cuernavaca, city	1656	849	5433
Tasco, city	1784	915	5852
Chilpansingo, city	1380	708	4527
Puebla de los Angeles, city	2194	1126	7198
Perote, town	2354	1208	7723
Xalapa, city	1321	678	4333
Valladolid, city	1952	1001	6404

Names of places of observation.	Height above the level of the sea, according to the formula of M. Laplace.		
	In metres.	In toises.	In Eng. feet.
Pazcuaro, city	2202	1130	7224
Charo, city	1907	978	6256
Villa de Islahuaca, in the intendancy of Valladolid	2585	1326	8481
San Juan del Rio, town	1978	1015	6489
Queretaro, city	1940	995	6364
Celaya, city	1835	941	6020
Salamanca, city	1757	902	5763
Guanaxuato, city	2084	1069	6836
Mine de la Valenciana	2328	1194	7637
Durango, city	2087*	1071	6847

END OF GEOGRAPHICAL INTRODUCTION.



POLITICAL ESSAY

ON THE

KINGDOM OF NEW SPAIN.

I ARRIVED at Mexico by the South Sea in March, 1803, and resided a year in that vast kingdom. I had recently visited the province of Caraccas, the banks of the Oronooko, the Rio Negro, New Granada, Quito, and the coast of Peru; and I could not avoid being struck with the contrast between the civilization of New Spain, and the scanty cultivation of those parts of South America which had fallen under my notice. This contrast excited me to a particular study of the statistics of Mexico, and to an investigation of the causes which have had the greatest influence on the progress of the population and national industry.

My situation offered me every means for attaining this end. No printed work could furnish me with materials, but I had at command a great number of manuscript memoirs, of which an active curiosity had spread copies through the most remote parts of the Spanish colonies. I compared the results of my own researches with those contained in the official papers which I had many years been collecting. A short, but interesting stay, which I made in 1804 at Philadelphia and Washington, enabled me also to draw

comparisons between the actual state of the Un States and that of Peru and Mexico.

Thus my geographical and statistical mater swelled to too great a bulk to admit of entering tl results in the historical account of my travels. flattered myself with the hope that a particular wc under the title of Political Essay on the Kingdon New Spain, might be received with interest a time when the new continent more than ever attr the attention of Europeans. Several copies of first sketch of this work, which I drew up in S ish, exist in Mexico, and in the peninsula. Beli ing that it might be useful to those called to administration of the colonies, who often, after a l residence, have no precise idea of the state of th beautiful and extensive regions, I communicated manuscript to all who desired to study it. Fr these reiterated communications I received many portant corrections. Even the Spanish governm honoured my researches with a particular attenti and they have furnished materials for several offi papers on the interests of the commerce and ma facturing industry of the colonies.

The work which I now publish is divided into grand sections. The first book consists of gen considerations on the extent and physical aspect New Spain. Without entering into any detai descriptive natural history, (a detail reserved for ot parts of my work,) I have examined the influenc the inequalities of the soil on the climate, agri ture, commerce, and defence of the coasts. The cond book treats of the general population and d sion of the casts. The third presents a partic statistical view of the intendancies, their populat and area, calculated from the maps drawn up by from my astronomical observations. I discuss the fourth book the state of agriculture, and of metallic mines; and in the fifth, the progress

manufactures and commerce. The sixth
tains researches into the revenues of the sta
military defence of the country.

Notwithstanding the extreme care whicl
ed in verifying the results, I have no doubt of hav
committed many very serious errors, which will be
pointed out in proportion as my work shall excite the
inhabitants of New Spain to study the state of their
country. I rely, however, on the indulgence of those
who know the difficulties of researches of this nature,
and who have compared together the statistical tables
which annually appear in the most civilized countries
of Europe.

BOOK I.

GENERAL CONSIDERATIONS ON THE EXTENT AND PHYSICAL ASPECT OF THE KINGDOM OF NEW SPAIN. INFLUENCE OF THE INEQUALITIES OF THE SOIL ON THE CLIMATE, AGRICULTURE, COMMERCE, AND MILITARY DEFENCE OF THE COUNTRY.

CHAPTER I.

Extent of the Spanish possessions in America. Comparison of these possessions with the English colonies, and with the Asiatic part of the Russian empire. Denominations of New Spain, and of Anahuac. Boundary of the empire of the Aztec kings.

BEFORE entering on a political view of the kingdom of *New Spain*, it may be of importance to bestow a rapid glance on the extent and population of the Spanish possessions in the two Americas. We must generalize our ideas, and consider each colony in its relations with the neighbouring colonies and with the mother country, if we would obtain accurate results, and assign to the country described the place to which it is entitled from its territorial wealth.

The Spanish possessions of the new continent occupy the immense extent of territory comprised between the 41° 43′ of south latitude, and the 37° 48′ of north latitude. This space of seventy-nine degrees

equals not only the length of all Africa, but it even much surpasses the breadth of the Russian empire, which includes about a hundred and sixty-seven degrees of longitude, under a parallel of which the degrees are not more than half the degrees of the equator.

The most southern point of the new continent inhabited by the Spaniards is Fort *Maullin*, near the small village of *Carelmapu*,* on the coast of Chili, opposite the northern extremity of the island of *Chiloe*. A road is opening from *Valdivia* to this fort of *Maullin;* a bold but useful undertaking, as a stormy sea prevents navigators for a great part of the year from landing on so dangerous a coast. On the south and south-east of Fort *Maullin* in the gulfs of *Ancud* and *Reloncavi*, by which we reach the great lakes of *Nahuelhapi* and *Todos los Santos*, there are no Spanish establishments; but we meet with them in the islands near the eastern coast of *Chiloe*, even in 43° 34′ of south latitude, where the island *Caylin* (opposite the lofty summit of the *Corcobado*) is inhabited by several families of Spanish origin.

The most northern point of the Spanish colonies is the mission of *San Francisco*, on the coast of New California, seven leagues to the north-west of *Santa Cruz*. The Spanish language is thus spread over an extent of more than 1,900 leagues in length. Under the wise administration of Count *Florida Blanca*, a regular communication of posts was established from *Paraguay* to the north-west coast of North America; and a monk in the mission of the *Guaranis* Indians can maintain a correspondence with another missionary inhabiting New Mexico, or the countries in the neighbourhood of Cape *Mendocin*, without

* See note A, at the end of the work.

their letters ever passing at any great distance from the continent of Spanish America.

The dominions of the king of Spain in America exceed in extent the vast regions possessed by the Russian empire, or Great Britain, in Asia. I thought, therefore, that a view of these differences and of the striking disproportion between the area and the population of the mother country, compared with those of the colonies, could hardly fail to be interesting. To make this disproportion appear still more palpable, I have formed, according to exact scales, the drawings in the last plate. A red parallelogram which serves for the base, represents the surface of the mother countries; and a blue parallelogram which reposes on the base, indicates the area of the Spanish and English possessions in America and Asia. These views, similar to those of M. Playfair, have something fearful in them, particularly when we fix our eyes on the grand catastrophe represented in the fourth figure, of which the memory is still recent among us. This plate alone should suggest important considerations to those who superintend the prosperity and tranquillity of the colonies. The dread of a future evil is undoubtedly in itself a motive of no great dignity; but it is a powerful motive of vigilance and activity for great political bodies as well as for simple individuals.

The Spanish possessions in America are divided into nine great governments, which may be regarded as independent of one another. Of these nine governments, five, viz. the viceroyalties of *Peru* and of *New Grenada*, the *capitanias generales* of *Guatimala*, of *Portorico*, and of *Caraccas*, are wholly comprised in the torrid zone; the four other divisions, viz. the viceroyalties of *Mexico* and *Buenos Ayres*, the *capitanias generales* of *Chili* and *Havannah*, including the Floridas, are composed of countries of which a great part is situated without the tropics,

that is to say, in the temperate zone. We shall afterwards see that this position alone does not determine the nature of the productions of these fine regions. The union of several physical causes, such as the great height of the Cordilleras, their enormous masses, the number of plains, elevated more than from two to three thousand metres* above the level of the ocean, give to a part of the equinoxial regions a temperature adapted to the cultivation of the wheat and fruit trees of Europe. The geographical latitude has small influence on the fertility of a country, where, on the ridge and declivity of the mountains, nature exhibits a union of every climate.

Among the colonies subject to the king of Spain, Mexico occupies at present the first rank, both on account of its territorial wealth, and on account of its favourable position for commerce with Europe and Asia. We speak here merely of the political value of the country, considering it in its actual state of civilization, which is very superior to that of the other Spanish possessions. Many branches of agriculture have undoubtedly attained a higher degree of perfection in the province of Caraccas than in New Spain. The fewer mines a colony has, the more the industry of the inhabitants is turned towards the productions of the vegetable kingdom. The fertility of the soil is greater in the provinces of *Cumana*, of *New Barcelona*, and *Venezuela*; and it is greater on the banks of the lower Orinoco, and in the northern part of New Grenada, than in the kingdom of Mexico, of which several regions are barren, destitute of water, and incapable of vegetation. But on considering the greatness of the population of Mexico, the number of considerable cities in the proximity of one another, the enormous value of the metallic produce, and its influence on the commerce of

* From 6,561 feet to 9,842 feet. *Trans.*

Europe and Asia; in short, on examining the imperfect state of cultivation observable in the rest of Spanish America we are tempted to justify the preference which the court of Madrid has long manifested for Mexico above its other colonies.

The denomination of New Spain designates, in general, the vast extent of country over which the viceroy of Mexico exercises his power. Using the word in this sense, we are to consider as northern and southern limits the parallels of the 38th and 10th degrees of latitude. But the *captain-general* of Guatimala, considered as administrator, depends very little on the viceroy of New Spain. The kingdom of *Guatimala* contains, according to its political division, the governments of *Costa Rica* and of *Nicaragua*. It is conterminous with the kingdom of New Grenada, to which *Darien* and the isthmus of Panama belong. Whenever in the course of this work we use the denominations of *New Spain* and *Mexico*, we exclude the *capitania-general* of *Guatimala*, a country extremely fertile, well peopled, compared with the rest of the Spanish possessions, and so much the better cultivated as the soil, convulsed by volcanoes, contains almost no metallic mines. We consider the intendancies of *Merida* and *Oaxaca* as the most southern, and at the same time the most eastern parts of New Spain. The confines which separate Mexico from the kingdom of *Guatimala* are washed by the Great Ocean to the east of the port of *Tehuantepec*, near *la Barra de Tonala*. They terminate on the shore of the Atlantic, near the bay of Honduras.

The name of *New Spain* was at first only given in the year 1518 to the province of *Yucatan*, where the companions in arms of Grijalva were astonished at the cultivation of the fields and the beauty of the Indian edifices. *Cortez*, in his first letter to the emperor Charles V. in 1520, employs the denomination

of New Spain for the whole empire of *Montezuma*. This empire, if we may believe *Solis*, extended from *Panama* to *New California*. But we learn from the diligent researches of a Mexican historian, the Abbé *Clavigero*,* that *Montezuma* the sultan of *Tenochtitlan* had a much smaller extent of country under his dominion. His kingdom was bounded towards the eastern coast by the rivers of *Guasacualco* and *Tuspan*, and towards the western coast by the plains of *Soconusco*, and the port of *Zacatula*. On looking into my general map of New Spain, divided into intendancies, it will be found, that according to these limits, the empire of Montezuma included only the intendancies of *Vera Cruz*, *Oaxaca*, *la Puebla*, *Mexico*, and *Valladolid*. I think its area may be estimated at 15,000 square leagues.

Towards the beginning of the 16th century, the river of *Santiago* separated the agricultural nations of *Mexico* and *Mechoacan* from the barbarous and pastoral hordes called *Otomites* and *Cicimecs*. These savages frequently carried their incursions as far as *Tula*, a town situated near the northern bank of the valley of *Tenochtitlan*. They occupied the plains of *Zelaya* and *Salamanca*, now admired for their fine cultivation, and the multitude of farms scattered over their surface.

Neither should the denomination of *Anahuac* be confounded with that of *New Spain*. Before the conquest, all the country between the 14th and 21st degrees of latitude was included under the name of Anahuac. Besides the Aztec empire of Montezuma, the small republics of *Tlaxcallan* and *Cholollan*, the kingdoms of *Tezcuco* (or *Acolhoacan*) and *Mechuacan*, which comprised part of the intendancy of Valladolid, belonged to the ancient *Anahuac*.

* *Dissertazione sopra i confini di Anahuac.* See *Storia antica del Messico*. T. IV. p. 265.

Even the name *Mexico* is of Indian origin. It signifies in the *Aztec* language the habitation of the God of War, called *Mexitli* or *Huitzilopochtli*. It appears, however, that before the year 1550 the city was more commonly called *Tenochtitlan* than *Mexico*. *Cortez*,* who had made very little progress in the language of the country, called the capital, through corruption, *Temixtitan*. These etymological observations will not be found too minute in a work which treats exclusively of the kingdom of Mexico. The audacious man who overturned the *Aztec* monarchy considered this kingdom sufficiently extensive to advise† Charles V. to unite the title of emperor of *New Spain* to that of Roman emperor.

We are tempted to compare together the extent and population of Mexico, and that of two empires with which this fine colony is in relations of union and rivalry. Spain is five times smaller than Mexico. Should no unforeseen misfortunes occur, we may reckon that in less than a century the population of New Spain will equal that of the mother country. The United States of North America since the cession of Louisiana, and since they recognise no other boundary than the *Rio Bravo del Norte*, contain 240,000 square leagues. Their population is not much greater than that of Mexico, as we shall afterwards see on examining carefully the population and the area of New Spain.

If the political force of two states depended solely

* Historia de Nueva Espana, por Lorenzana, (Mexico, 1770, p. 1.)

† Cortez says, in his first letter, dated from Villa Segura de la Frontera, the 30th October, 1520: "Las cosas de esta terra son tantas y tales que Vuestra Alteza se puede entitular de nuevo Emperador de ella, y con titulo y non menos merito, que el de Alemana, que por la gracia de Dios. Vuestra Sacra Magestad possee." (Lorenzana, p. 38.)

on the space which they occupy on the globe, and on the number of their inhabitants; if the nature of the soil, the configuration of thecoast; and if the climate, the energy of the nation, and above all the degree of perfection of its social institutions, were not the principal elements of this grand dynamical calculation, the kingdom of New Spain might, at present, be placed in opposition to the confederation of the American republics. Both labour under the inconvenience of an unequally distributed population; but that of the United States, though in a soil and climate less favoured by nature, augments with an infinitely greater rapidity. Neither does it comprehend, like the Mexican population, nearly two millions and a half of aborigines. These Indians, degraded by the despotism of the ancient *Aztec* sovereigns, and by the vexations of the first conquerors, though protected by the Spanish laws, wise and humane in general, enjoy very little, however, of this protection, from the great distance of the supreme authority. The kingdom of New Spain has one decided advantage over the United States. The number of slaves there, either Africans or of mixed race, is almost nothing; an advantage which the European colonists have only begun rightly to appreciate since the tragical events of the revolution of St. Domingo. So true it is, that the fear of physical evils acts more powerfully than moral considerations on the true interests of society, or the principles of philanthropy and of justice, so often the theme of the parliament, the constituent assembly, and the works of the philosophers.

The number of African slaves in the United States amounts to more than a million, and constitute a sixth part of the whole population. The southern states, whose influence is increased since the acquisition of Louisiana, very inconsiderately increase the annual importation of these negroes. It is not yet

in the power of Congress, nor the chief of the confederation, (a magistrate* whose name is dear to the true friends of humanity,) to oppose this augmentation, and to spare by that means much distress to the generations to come.

CHAPTER II.

Configuration of the coast. Points where the two seas are least distant from one another. General considerations on the possibility of uniting the South Sea and Atlantic Ocean. Rivers of Peace and Tacoutche-Tesse. Sources of the Rio Bravo and Rio Colorado. Isthmus of Tehuantepec. Lake of Nicaragua. Isthmus of Panama. Bay of Cupica. Canal of Choco. Rio Guallaga. Gulf of St. George.

The kingdom of New Spain, the most northern part of all Spanish America, extends from the 16th to the 38th degree of latitude. The length of this vast region in the direction of S. S. E. to N. N. W. is nearly 270 myriametres; (or 610 common leagues;) its greatest breadth is under the parallel of the 30th degree. From the *Red River* of the province of *Texas* (Rio Colorado) to the Isle of *Tiburon*, on the coast of the intendancy of *Sonora*, the breadth from east to west is 160 myriametres (or 364 leagues.)

The part of Mexico in which the two oceans, the Atlantic and the South Sea, approach the nearest to one another, is unfortunately not that part which contains the two ports of Acapulco and Vera Cruz, and the capital of Mexico. There are, according to my astronomical observations, from *Acapulco* to *Mexico* an oblique distance of 2° 40′ 19″; (or 155,885 toises;†) from Mexico to Vera Cruz 2° 57′ 9″; (or

* The present president, Mr. Thomas Jefferson, author of the excellent Essay on Virginia.

† 997,664 feet. *Trans.*

158,572 toises;*) and from the port of Acapulco
the port of Vera Cruz, in a direct line, 4° 10′ 7″.
is in these distances that the old maps are most fault
From the observations published by *M. de Cassi*
in the account of the voyage of Chappe, the di
tance from Mexico to Vera Cruz appears 5° 10′
longitude, instead of 2° 57′, the real distance b
tween these two great cities. In adopting for Ve
Cruz the longitude given by Chappe, and for Acapul
that of the map of the *Depôt* drawn up in 1784, t
breadth of the Mexican isthmus betwixt the two po
would be 175 leagues, 75 leagues beyond the tru

The isthmus of Tehuantepec, to the S. E. of t
port of *Vera Cruz*, is the point of New Spain
which the continent is narrowest. From the Atla
tic Ocean to the South Sea the distance is 45 leagu
The approximation of the sources of the rive
Huasacualco and *Chimalapa* seems to favour t
project of a canal for interior navigation; a proje
with which the Count of Revillagigedo, one of t
most zealous viceroys for the public good, has be
for a long time occupied. When we come to spe
of the intendancy of Oaxaca, we shall return to th
object, so important to all civilized Europe. W
must confine ourselves here to the *problem of t
communication between the two seas*, in all the gen
rality of which it is susceptible. We shall prese
in one view nine points, several of which are n
sufficiently known in Europe, and all offer a great
or less probability either of canals or interior riv
communications. At a time when the New Cont
nent, profiting by the misfortunes and perpetual di
sensions of Europe, advances rapidly towards civil
zation; and when the commerce of China, and th
north-west coast of America, becomes yearly c
greater importance, the subject which we here sum

* 1,014,860 feet. *Trans.*

manly discuss is of the greatest interest for the *balance of commerce*,* and the political preponderancy of nations.

These nine points, which at different times have fixed the attention of statesmen and merchants in the colonies, present very different advantages. We shall range them according to their geographical position, beginning with the most northern part of the New Continent, and following the coasts to the south of the island of *Chiloe*. It can only be after having examined *all* the projects hitherto formed for the communication of the two seas, that the government can decide which of them merits the preference. Before this examination, exact materials for which are not yet collected, it would be imprudent to cut canals in the isthmuses of *Guasacualco* or *Panama*.

1. Under the 54° 37′ of north latitude, in the parallel of *Queen Charlotte's Island*, the sources of the river of Peace, or *Ounigigah*, approach to within seven leagues of the sources of the *Tacoutche-Tesse*, supposed the same with the river of *Colombia*. The first of these rivers discharges itself into the Northern Ocean, after having mingled its waters with those of the *Slave Lake*, and the river Mackenzie. The second river, Colombia, enters the Pacific Ocean, near Cape *Disappointment*, to the south of Nootka Sound, according to the celebrated voyager, Vancouver, under the 46° 19′ of latitude. The Cordillera, or chain of the *Stony Mountains*, abounding in coal, was found by M. *Fiedler* to be elevated in some places 3,520 English feet,† or 550 toises above the neighbouring

* It may be necessary to inform the reader, that he is indebted for this *term*, at present in some sort of disrepute from the proscription of political economists, however much the *idea* may still haunt the wise heads of our commercial men, to the author and not to me. *Trans.*

† If it be true that this chain of mountains enters the region of perpetual snow, (Mackenzie, vol. III. p. 331.) their

plains. It separates the sources of the rivers of *Peace* and Colombia. According to Mackenzie's account, who passed this Cordillera in the month of August, 1793, it is practicable enough for carriages, and the mountains appear of no very great elevation. To avoid the great winding of the Colombia, another communication still shorter might be opened from the sources of the *Tacoutche-Tesse* to the Salmon river, the mouth of which is to the east of the *Princess Royal Islands*, in the 52° 26′ of latitude. Mackenzie rightly observes, that the government which should open this communication between the two oceans, by forming regular establishments in the interior of the country, and at the extremities of the rivers, would get possession of the whole fur trade of North America, from the 48° of latitude to the pole, excepting a part of the coast which has been long included in Russian America. *Canada*, from the multitude and course of its rivers, presents facilities for internal commerce similar to those of *Oriental Siberia*. The mouth of the river Colombia seems to invite Europeans to found a fine colony there; for its banks afford fertile land in abundance covered with superb timber. It must be allowed, however, that notwithstanding the examination by Mr. Broughton, we still know but a very small part of Colombia, which, like the *Severn* and the *Thames*, appears of a disproportionate contraction as it leaves the coast. Every geographer who carefully compares Mackenzie's maps with Vancouver's, will be astonished that the *Colombia* in descending from these *Stony Mountains*,

absolute height should be at least from 1,000 to 1,100 toises; (from 6,400 to 7,040 English feet;) from whence it would follow, either that the neighbouring plains, on which M. Fiedler was stationed to establish his measurements, are elevated from 450 to 550 toises above the level of the sea, or that the summits, of which this traveller indicates the height, are not the most elevated of the chain crossed by Mackenzie.

which we cannot help considering as a prolongation of the *Andes* of Mexico, should traverse the chain of mountains which approach the shore of the Great Ocean, whose principal summits are Mount *St. Helen* and *Mount Rainier*. But *M. Malte-Brun* has started important doubts concerning the identity of the *Tacoutche-Tesse* and the *Rio Colombia*. He even presumes that the former discharges itself into the gulf of California;* a bold supposition, which would give to the *Tacoutche-Tesse* a course of an enormous length. It must be allowed that all that part of the west of North America is still but very imperfectly known.

In the 50° of latitude, the *Nelson* river, the *Saskatchawan* and the *Missouri*, which may be regarded as one of the principal branches of the *Mississippi*, furnish equal facilities of communication with the Pacific Ocean. All these rivers take their rise at the foot of the *Stony Mountains*. But we have not yet sufficient acquaintance with the nature of the ground through which the communication is proposed to be established, to pronounce upon the utility of these projects. The journey of Captain Lewis, at the expense of the Anglo-American government, on the Mississippi and the Missouri, may throw considerable light on this interesting problem.

2. Under the 40° of latitude, the sources of the *Rio del Norte*, or *Rio Bravo*, a considerable river which flows into the gulf of Mexico, are only separated from the sources of the *Rio Colorado* by a mountainous tract of from twelve to thirteen leagues of breadth. This tract is the continuation of the *Cordillera* of the *Cranes*, which stretches towards the *Sierra Verde* and the lake of *Timpanogos*, celebrated in the Mexican history. The *Rio S. Rafael* and the *Rio S. Xavier* are the principal sources of the river

* Geogr. Mathem. vol. XV. p. 117.

Zaguananas, which, with the *Rio de Nabajoa*, for the *Rio Colorado*: the latter has its *embouchure* in t gulf of California. These regions, abounding rock salt, were examined in 1777 by two travelle full of zeal and intrepidity, monks of the order St. Francis, Father *Escalante* and Father *Anto Velez*. But however interesting the *Rio Zaguanan* and the *Rio del Norte* may one day become for t internal commerce of this northern part of Ne Spain, and however easy the carriage may be acro the mountains, no communication will ever resu from it comparable to that opened directly from s to sea.

3. The *isthmus* of *Tehuantepec* comprises, und the 16° of latitude, the sources of the *Rio Huasac -alco*, which is discharged into the gulf of Mexic and the sources of the Rio de *Chimalapa*. The w ters of this last river mix with those of the Pacif Ocean near the *Barra de S. Francisco*. I consid here the *Rio del Passo* as the principal source of t river *Huasacualco*, although the latter only takes i name at the *Passo de la Fabrica*, after one of i arms, which comes from the mountains *de los Mexe* unites with the *Rio del Passo*. We shall examin afterwards the possibility of cutting a canal of fro six to seven leagues in the forests of *Tarifa*. W shall merely observe here, that since, in 1793, a roa has been opened which leads by land from the po of *Tehuantepec*, to the *Embarcadero de la Cruz*, (road completed in 1800,) the *Rio Huasacualco* form in reality, a commercial communication between th two oceans. During the course of the war with th English, the indigo of *Guatimala*, the most precio of all known indigoes, came by the way of thi isthmus to the port of *Vera Cruz*, and from thenc to Europe.

4. The great lake of *Nicaragua* communicates n only with the lake of *Leon*, but also on the east, b

the river of *San Juan*, with the sea of the *Antilles*. The communication with the Pacific Ocean would be effected in cutting a canal across the isthmus which separates the lake from the gulf of *Papagayo*. On this strait isthmus are to be found the volcanic and isolated summits of *Bombacho*, (at 11° 7′ of latitude,) of Grenada, and of the *Papagayo*, (at 10° 50′ of latitude.) The old maps point out a communication by water as existing across the isthmus from the lake to the Great Ocean. Other maps, somewhat newer, represent a river under the name of *Rio Partido*, which gives one of its branches to the Pacific Ocean, and the other to the lake of Nicaragua; but this divided stream does not appear on the last maps published by the Spaniards and English.

There are in the archives of Madrid several French and English memoirs,* on the possibility of the junction of the lake of Nicaragua with the Pacific Ocean. The commerce carried on by the English on the coast of *Mosquitos* has greatly contributed to give celebrity to this project of communication between the two seas. In none of the memoirs which have come to my knowledge is the principal point, the height of the ground in the isthmus, sufficiently cleared up.

From the kingdom of *New Grenada* to the environs of the capital of Mexico, there is not a single mountain, a single level, a single city, of which we know the elevation above the level of the sea. Does there exist an *uninterrupted* chain of mountains in the provinces of *Veragua* and *Nicaragua*? Has this cordillera, which is supposed to unite the Andes of Peru to the mountains of Mexico, its *central chain* to the west or the east of the lake of *Nicaragua*?

* Mémoire sur le passage de la Mer du Sud à la Mer du Nord, par M. la Bastide, en 1791. Voyage de Marchand, vol. i. p. 505. Mapa del Golfo de Mexico, por Thomas Lopez y Juan de la Cruz, 1755.

Would not the isthmus of *Papagayo* rather presen a hilly tract than a continued cordillera? These a problems whose solution is equally interesting to th statesman and the geographical naturalist!

There is no spot on the globe so full of volcano as this part of America, from the 11° or 13° of lat tude; but do not these conical summits form grou which, separately from one another, rise from th plan itself? We ought not to be astonished that w are ignorant of these very important facts; we sha soon see that even the height of the mountains whic traverse the isthmus of Panama is not yet know Perhaps the communication of the lake of Nicaragu with the Pacific Ocean could be carried on by the lak of *Leon*, by means of the river Tosta, which, c the road from *Leon* to *Realexo*, descends from th volcano of *Telica*. In fact, the ground appears ther very little elevated. The account of the voyage *Dampier* leads us even to suppose that there exis no *chain of mountains* between the lake of Nicaragu and the South Sea. "The coast of Nicoya," say this great navigator, "is low, and covered at full tid To arrive from *Realexo* to Leon, we must go twen miles across a country flat and covered with mang trees." The city of Leon itself is situated in a s vanna. There is a small river which, passing ne Realexo, might facilitate the communication betwe the latter port and that of Leon.* From the we bank of the lake of Nicaragua there are only fo marine leagues to the bottom of the gulf of *Pap gayo*, and seven to that of *Nicoya*, which navigato call *la Caldera*. Dampier says expressly that th ground between *la Caldera* and the lake is a litt hilly, but for the greatest part level and like a s vanna.

* Collection of Dampier's and Wafer's voyages, vol. i. 113. 119. 218.

The coast of *Nicaragua* is almost inaccessible in the months of August, September and October, on account of the terrible storms and rains; in January and February, on account of the furious north-east and east-north-east winds, called *Papagayos*. This circumstance is exceedingly inconvenient for navigation. The port of *Tehuantepec*, on the isthmus of *Guasacualco*, is not more favoured by nature; it gives its name to the hurricanes which blow from the north-west, and which frighten vessels from landing at the small ports of *Sabinas* and *Ventosa*.

5. The *isthmus* of *Panama* was crossed for the first time by *Vasco Nunez de Balboa*, in 1513. Since this memorable epocha in the history of geographical discoveries, the project of a canal has occupied every mind; and yet at this day, after the lapse of 300 years, there neither exists a survey of the ground, nor an exact determination of the positions of *Panama* and *Portobello*. The longitude of the first of these two ports has been found with relation to Carthagena; the longitude of the second has been fixed from Guayaquil. The operations of *Fidalgo* and *Malaspina* are undoubtedly deserving of very great confidence; but errors are insensibly multiplied, when by chronometrical operations from the isle of *Trinidad* to Portobello, and from *Lima* to *Panama*, one position becomes dependent on another. It would be important to carry the time directly from *Panama* to *Portobello*, and thus to connect the operations in the South Sea with those which the Spanish government has carried on in the Atlantic Ocean. Perhaps MM. *Fidalgo*, *Tiscar*, and *Noguera*, may one day advance with their instruments to the southern coast of the isthmus, while MM. *Colmenares*, *Isasviravill*, and Quartara, shall carry their operations* to the northern

*These officers of the Spanish marine were charged with surveying the northern and western coasts of South America.

coast. To form an idea of the uncertainty which still prevails as to the form and breadth of the isthmus, (for example towards *Nata*,) we have only to compare the maps of Lopez with those of Arrowsmith, and with the more recent ones of the *Deposito Hydrografico* of Madrid. The river *Chagre*, which flows into the sea of the Antilles to the west of *Portobello*, presents, notwithstanding its sinuosities and its rapids, great facility for commerce; its breadth is 120 toises at its mouth, and 20 toises near *Cruces*, where it begins to be navigable. It requires four or five days at present to ascend the *Rio Chagre* from its mouth to *Cruces*. If the waters are very high, the current must be struggled with for ten or twelve days. From *Cruces* to Panama merchandises are transported on the backs of mules for a space of five small leagues. The barometrical heights related in the travels of Ulloa* lead me to suppose that there exists in the *Rio Chagre*, from the sea of the Antilles to the *Embarcadero*, or *Venta de Cruces*, a difference of level of from 35 to 40 toises. This must appear a very small difference to those who have ascended the *Rio Chagre*; they forget that the force of the current depends as much on a great accumulation of water near the sources, as on the general descent of the river; that is to say, of the descent of the *Rio Chagre* above *Cruces*. On comparing the barometrical survey of Ulloa with that made by myself in the river of *Magdelen*, we perceive that the elevation of *Cruces* above the ocean, far from being small, is, on the contrary, very considerable. The fall of the

The expedition of Fidalgo was destined for the coast situated between the isle of *Trinidad* and *Portobello*, the expedition of *Colmenares* for the coast of *Chili*, and the expedition of *Moraleda* and *Quartara* for the part between *Guayaquil* and *Realexo*.

* Observations Astronomiques d'Ulloa, p. 97.

Rio de la Madelena from Honda to the dyke of *Matates*, near *Barrancas*, is nearly 170 toises;* and this distance nevertheless is not as we might suppose four times, but eight times, greater, than that of Cruces at the *fort* of *Chagre*.

The engineers in proposing to the court of Madrid that the river *Chagre* should serve for establishing a communication between the two oceans, have projected a canal from the *Venta de Cruces* to *Panama*. This canal would have to pass through a hilly tract of the height of which we are completely ignorant. We only know that, from Cruces, the ascent is at first rapid, and that there is then a descent for several hours towards the South Sea. It is very astonishing that, in crossing the isthmus, neither *La Condamine* nor *Don George Juan* and *Ulloa* had the curiosity to observe their barometer, for the sake of informing us what is the height of the most elevated point on the route to the castle of *Chagre* at *Panama*. These illustrious *savans* sojourned three months in that interesting region for the commercial world; but their stay has added little to the old observations which we owe to *Dampier* and to *Wafer*. However, it appears beyond a doubt that we find the principal *Cordillera*, or rather a range of hills that may be regarded as a prolongation of the *Andes* of *New Grenada*, towards the South Sea, between *Cruces* and *Panama*. It is from thence that the two oceans are said to be discernible at the same time, which would only require an absolute height of 290 metres.† However, *Lionel Wafer* complains that he could not enjoy this interesting spectacle. He assures us, moreover, that the hills which form the central chain are separated from one another by valleys which allow *free course* for passage of the rivers.‡ If this last assertion be

* 1,088 feet. *Trans.*

† 947 English feet. *Trans.*

‡ Description of the isthmus of America, 1729, p. 297.

founded, we might believe in the possibility of a canal from *Cruces* to *Panama*, of which the navigation would only be interrupted by a very few locks.

There are other points where, according to memoirs drawn up in 1528, the isthmus has been proposed to be cut, for example in joining the sources of the rivers called *Caimito* and *Rio Grande*, with the *Rio Trinidad*. The eastern part of the isthmus is the narrowest, but the ground appears to be also most elevated there. This is at least what has been remarked in the frightful road travelled by the courier from Portobello to Panama, a two days journey, which goes by the village of *Pequeni*, and is full of the greatest difficulties.

In every age and climate, of two neighbouring seas, the one has been considered as more elevated than the other. Traces of this vulgar opinion are to be found among the ancients. *Strabo* relates, that in his time the gulf of Corinth near *Lechaeum* was believed to be above the level of the sea of *Cenchreae*. He is of opinion* that it would be very dangerous to cut the isthmus of the Peloponnesus in the place where the Corinthians, by means of particular machines, had established a *portage*. In America, the South Sea is generally supposed to be higher at the isthmus of Panama than the Atlantic Ocean. After a struggle of several days against the current of the Rio Chagre, we naturally believe the ascent to be greater than the descent from the hills near *Cruces* to *Panama*. Nothing in fact, can be more treacherous than the estimates which we are apt to form of the difference of level on a long and easy descent. I could

Near the town of Panama, a little to the north of the port, is the mountain of *L'Ancon*, which, according to a geometrical measurement, is 101 toises (646 feet) in height. Ulloa, vol. I. p. 101.

* Strabo, lib. 1. ed. Siebenkees, v. I. p. 146. Livius, lib. 42. cap. 16.

hardly believe my own eyes at Peru, when I found by means of a barometrical measurement, that the city of *Lima* was 91 toises* higher than the port of Callao. An earthquake must cover entirely the rock of the isle *San Lorenzo* with water before the ocean can reach the capital of Peru. The idea of a difference of level between the Atlantic and South Sea has been combated by *Don George Juan*, who found the height of the column of mercury the same at the mouth of the *Chagre* and at *Panama*.

The imperfection of the meteorological instruments then in use, and the want of every sort of thermometrical correction of the calculation of heights might also give rise to doubts. These doubts have acquired additional force since the French engineers in the expedition to Egypt, found the *Red Sea* six toises† higher than the *Mediterranean*. Till a geometrical survey be executed in the isthmus itself, we can only have recourse to barometrical measurements. Those made by me at the mouth of the *Rio Sinu* in the Atlantic Sea, and on the coast of the South Sea in Peru, prove, with every allowance for temperature that if there is a difference of level between the two seas, it cannot exceed six or seven metres.‡

When we consider the effect of the *current of rotation*,§ which carries the waters from east to west, and accumulates them towards the coast of *Costa Ricca* and *Veragua*, we are tempted to admit, contrary to the received opinion, that the Atlantic is a little higher than the South Sea. Trivial causes of a local nature, such as the configuration of the coast, cur-

* 582 feet. *Trans.*

† 38 feet. *Trans.*

‡ 19 or 22 feet. *Trans.*

§ I call *current of rotation* the general motion from east to west, observed in the part of the ocean comprised in the torrid zone.

rents and winds, (as in the straits of *Babelmandel*,) may trouble the equilibrium which ought necessarily to exist between all the parts of the ocean. As the tides rise at Portobello to a third part of a metre,* and at Panama to four or five metres,† the levels of the two neighbouring seas ought to *vary* with the different *establishments of the ports*. But these trivial inequalities, far from obstructing hydraulical operations, would even be favourable for sluices.

We cannot doubt that if the isthmus of *Panama* were once burst by some similar catastrophe to that which opened the columns of Hercules,‡ the current of rotation in place of ascending towards the gulf of Mexico, and issuing through the canal of Bahama, would follow the same parallel from the coast of Paria to the Philippine islands. The effect of this opening, or new strait, would extend much beyond the banks of *Newfoundland*, and would either occasion the disappearance or diminish the celerity of the Hotwater river, known by the name of *Gulf Stream*,§ which leaving Florida on the north-east, flows in the 43° of latitude to the east, and especially the south-east towards the coast of Africa. Such would be the effects of an inundation analogous to that of which the memory has been preserved in the traditions of

* 13 inches. *Trans.* † 13 or 16 feet. *Trans.*

‡ Diodorus Siculus, lib. iv. p. 226. lib. xvii. p. 533. edit. Rhodom.

§ The Gulf Stream, on which *Franklin*, and afterwards *Williams*, have left us such valuable observations, carries rapidly the tropical waters to the northern latitudes. It is occasioned by the current of rotation which strikes against the coasts of *Veragua* and *Honduras*, and ascending towards the gulf of Mexico, between Cape *Catoche* and Cape *St. Antoine*, issues through the canal of Bahama. It is owing to this motion that the vegetable productions of the Antilles are carried to Norway, Ireland, and the Canaries. See the second volume of my voyage to the tropics, chap. i.

the *Samothracians*. But shall we dare to compare the pitiful works of man with canals cut by nature herself, with straits like the Hellespont and the Dardanelles!

Strabo* appears inclined to believe that the sea will one day open the isthmus of *Suez*. No such catastrophe can be expected in the isthmus of *Panama*, unless enormous volcanic convulsions, very improbable in the actual state of repose of our planet, should occasion extraordinary revolutions. A tongue of land lengthened out from east to west in a direction almost parallel to that of the current of rotation escapes, as it were, the shock of the waves. The isthmus of Panama would be seriously threatened, if it extended from south to north, and was situated between the port of *Carthago* and the mouth of the *Rio San Juan*, if the narrowest part of the new continent lay between the 10° and the 11° of latitude.

The navigation of the river *Chagre* is difficult, both on account of its sinuosities and the celerity of the current, frequently from one to two metres per second.† These sinuosities however afford a *counter current*, by means of which the small vessels called *bungos*, and *chatas*, ascend the river, either with oars, poles, or towing. Were these sinuosities to be cut, and the old bed of the river to be dried up, this advantage would cease, and it would be infinitely difficult to arrive from the North Sea to Cruces.

From all the information which I could procure relating to this isthmus, while I remained at *Carthagena* and *Guayaquil*, it appears to me, that the expectation of a canal of seven metres‡ in depth, and from

* Strabo, ed. Siebenkees, T. I. p. 156.

† From 3.28 to 6.56 feet. *Trans.*

‡ 22 feet 11 inches. *Trans.*

twenty-two to twenty-eight metres* in breadth, which, like a pass or a strait, should go from sea to sea, and admit the vessels which sail from Europe to the East Indies, ought to be completely abandoned. The elevation of the ground would force the engineer to have recourse either to subterraneous galleries, or to the system of sluices; and the merchandises destined to pass the isthmus of Panama could only therefore be transported in flat-bottomed boats unable to keep the sea. Entrepots at Panama and Portobello would be requisite. Every nation which wished to trade in this way would be dependent on the masters of the isthmus and canal; and this would be a very great inconvenience for the vessels despatched from Europe. Supposing then that this canal were cut, the greatest number of these vessels would probably continue their voyage round *Cape Horn*. We see that the passage of the sound is still frequented, notwithstanding the existence of the *Eyder* canal, which connects the ocean with the Baltic sea.

It would be otherwise with the productions of western America, or the goods sent from Europe to the coast of the Pacific Ocean. These goods would cross the isthmus at less expense, and with less danger, particularly in time of war, than in doubling the southern extremity of the new continent. In the present state of things, the carriage of three quintals on mule-back from *Panama* to *Portobello* costs from three to four piasters, (from 12*s*. 6*d*. to 16*s*. 8*d*.) But the uncultivated state in which the government allows the isthmus to remain is such, that the carriage of the copper of Chili, the quinquina of Peru, and the 60 or 70,000 vanegas of cacao† annually exported by Guayaquil, across this neck of land, requires

* From 72 feet 2 inches, to 91 feet 10 inches. *Trans.*

† A vanega weighs 110 Castilian pounds.

many more beasts of burthen than can be procured, so that the slow and expensive navigation round Cape Horn is preferred.

In 1802 and 1803, when the Spanish commerce was every where harassed by the English cruizers, a great part of the cacao was carried across the kingdom of New Spain, and embarked at *Vera Cruz* for Cadiz. They preferred the passage from *Guayaquil* to *Acapulco*, and a land journey of a hundred leagues from *Acapulco* to *Vera Cruz*, to the danger of a long navigation by Cape Horn, and the difficulty of struggling with the current along the coasts of Peru and Chili. This example proves, that, if the construction of a canal across the isthmus of Panama, or that of Guasacualco, abounds with too many difficulties from the multiplicity of sluices, the commerce of America would gain the most important advantages from good causeys carried from *Tehuantepec* to the *Embarcadero de la Cruz*, and from *Panama* to *Portobello*. It is true that in the isthmus, the pasturage* to this day is very unfavourable to the nourishment and multiplication of cattle; but it would be easy in so fertile a soil to form savannas, by cutting down forests, or to cultivate the *paspalum purpureum*, the *milium nigricans* and particularly the *medicago sativa*, which grows abundantly in Peru in the warmest districts. The introduction of camels would be still a surer means of diminishing the expense of carriage. These *land ships*, as they are called by the orientals, hitherto exist only in the province of *Caraccas*, and were brought there from the Canary islands by the Marquis de Toro.

Moreover, no political consideration should oppose the progress of population, agriculture, com-

* The assertion of Raynal, (T. IV. p. 150.) that domestic animals transported to Portobello lose their fecundity, should be considered as totally destitute of truth.

merce and civilization, in the isthmus of Panama. The more this neck of land shall be cultivated, the more resistance will it oppose to the enemies of the Spanish government. The events which took place at *Buenos Ayres* prove the advantages of a concentrated population in the case of an invasion. If any enterprising nation wished to become possessed of the isthmus, it could do so with the greatest ease at present, when good and numerous fortifications are destitute of arms to defend them. The unhealthiness of the climate, though now much diminished at Portobello, would alone oppose great obstacles to any military undertaking in the isthmus. It is from *St. Charles de Chiloe*, and not from Panama, that Peru can be attacked. It requires from three to five months to ascend from Panama to Lima. But the whale and *cachalot* fishery, which in 1803 drew 60 English vessels to the South Sea, and the facilities for the Chinese commerce and the furs of Nootka Sound, are baits of a very seductive nature. They will draw, sooner or later, the masters of the ocean to a point of the globe destined by nature to change the face of the commercial system of nations.

6. To the south-east of *Panama*, following the coast of the Pacific Ocean, from Cape *S. Miguel* to Cape *Corientes*, we find the small port and bay of Cupica. The name of this bay has acquired celebrity in the kingdom of *New Grenada*, on account of a new plan of communication between the two seas. From *Cupica*, we cross, for five or six marine leagues, a soil quite level and proper for a canal, which would terminate at the *Embarcadero* of the *Rio Naipi*. This last river is navigable, and flows below the village of *Zitara* into the great *Rio Atrato*, which itself enters the Atlantic Sea. A very intelligent Biscayan pilot, M. Goguenechc, was the first who had the merit of turning the attention of government to the bay of Cupica, which ought to be for the new conti-

ment what Suez was formerly for Asia. M. Goguenèche proposed to transport the cacao of *Guayaquil*, by the *Rio Naipi* to *Carthagena*. The same way offers the advantage of a very quick communication between *Cadiz* and *Lima*. Instead of despatching couriers by *Carthagena*, *Santa Fe*, and *Quito*, or by *Buenos Ayres* and *Mendoza*, good quick sailing packet-boats should be sent from *Cupica* to *Peru*. If this plan were carried into execution, the viceroy of Lima would have no longer to wait five or six months for the orders of his court. Besides the environs of the *Bay of Cupica* abounds with excellent timber fit to be carried to Lima. We might almost say that the ground between *Cupica* and the mouth of the *Atrato* is the only part of all America in which the *chain of the Andes* is entirely broken.

7. In the interior of the province of *Choco*, the small ravine (Quebrada) *de la Raspadura*, unites the neighbouring sources of the *Rio de Noanama*, called also *Rio San Juan*, and the small river *Quito*. The latter, the *Rio Andageda* and the *Rio Zitara*, form the *Rio d'Atrato* which discharges itself into the Atlantic Ocean, while the *Rio San Juan* flows into the South Sea. A monk of great activity, *curé* of the village of *Novita*, employed his parishioners to dig a small canal in the ravine *de la Raspadura*, by means of which, when the rains are abundant, canoes loaded with cacao *pass from sea to sea*. This interior communication has existed since 1788, unknown in Europe. The small canal of Raspadura unites, on the coasts of the two oceans, two points 75 leagues distant from one another.

8. In the 10° of south latitude, two or three days journey from Lima, we reach the banks of the *Rio Guallaga*, (or Huallaga,) by which we may, without doubling Cape Horn, arrive at the banks of the *grand Para* in Brazil. The sources even of the Rio

Huanuco,* which runs into the *Guallaga*, are only four or five leagues distant from the source of the *Rio Huaura*, which flows into the Pacific Ocean. The *Rio Xauxo*, also, which contributes to form the *Apuremac* and the *Ucayale*, has its rise near the source of the *Rio Rimac*. The height of the Cordillera, and the nature of the ground, render the execution of a canal impossible; but the construction of a commodious road, from the capital of Peru to the *Rio de Huanaco*, would facilitate the transport of goods to Europe. The great rivers *Ucayale* and *Guallaga* would carry in five or six weeks the productions of Peru to the mouth of the *Amazons*, and to the neighbouring coasts of Europe, while a passage of four months is requisite to convey the same goods to the same point, in doubling Cape Horn. The cultivation of the fine regions situated on the *eastern declivity* of the Andes, and the prosperity and wealth of their inhabitants, depend on a *free* navigation of the river of the Amazons. This liberty, denied by the court of Portugal to the Spaniards, might have been acquired in the sequel to the events which preceded the peace of 1801.

9. Before the *coast of the Patagonians* was sufficiently known, the *Gulf of St. George*, situated between the 45° and the 47° of south latitude, was supposed to enter so far into the interior of the country, as to communicate with the arms of the sea which interrupt the continuity of the western coast, that is to say, with the coast opposite to the archipelago of *Chayamapu*. Were this supposition founded on solid

* See the maps given by Father *Sobreviola*, in the third volume of an excellent literary journal published at Lima, under the title of *Mercurio Peruviano*. The work of Skinner, on Peru, is an extract from this journal, of which some volumes, unfortunately not the most interesting, have found their way to London. I deposited the whole work in the king's library, at Berlin.

lases, the vessels destined for the South Sea might cross South America 7° to the north of the Straits of *Magellan*, and shorten their route more that 700 leagues. In this way, navigators might avoid the dangers which, notwithstanding the perfection of nautical science, still accompany the voyage round Cape Horn and along the Patagonian coast, from Cape *Pilares* to the parallel of the *Chonos* islands. These ideas, in 1790, occupied the attention of the court of Madrid. *M. Gil Lemos*, viceroy of Peru, an upright and zealous administrator, equipped a small expedition under the orders of *M. Moraleda*,* to examine the southern coast of Chili. I saw the instructions that he received at Lima, which recommended to him the greatest secrecy in case he should be happy enough to discover a *communication between the two seas*. But M. Moraleda discovered in 1793, that the *Estero de Aysen*, visited before him in 1763 by the jesuits, fathers *Jose Garcia* and *Juan Vicuna*, was of all the arms of the sea that in which the waters of the ocean advance the farthest towards the east. Yet it is but eight leagues in length, and terminates at the *isle de la Cruz*, where it receives a small river, near a hot spring. Hence the canal of Aysen, situated in the 45° 28′ of latitude, is still 88 leagues distant from the Gulf of St. George. This gulf was exactly survey-

* Don Jose de Moraleda y Montero visited the archipelagos of Chiloe and Chonos, and the western coast of the Patagonians, from 1787 down to 1796. Two very interesting manuscripts, drawn up by M. Moraleda, are to be found in the archives of the viceroyalty of Lima: the title of the one is, *Viage al Reconocimiento de los Islos de Chiloe*, 1786; the other comprehends the *Reconocimiento del Archipelago de los Chonos y Costa occidental Patagonica*, 1792—1796. Curious and interesting extracts might be published from these journals, which contain details regarding the cities de los Cesares and de l'Arguello, which are said to have been founded in 1554, and are placed by apocryphal accounts between 42° and 49° of south latitude.

ed by the expedition of Malaspina. In the year 1746 a communication was, in the same manner, suspected in Europe between the bay of *St. Julien* (latitude 50° 53′) and the Great Ocean.

I have sketched in one plate the nine points which appear to afford means of communication between the two oceans, by the junction of neighbouring rivers, either by canals or carriage-roads between the places where the rivers become navigable. These sketches are not of equal accuracy, astronomically considered; but I wished to save the reader the labour of seeking in several maps what may be contained in one; and it is the duty of the government which possesses the finest and most fertile part of the globe to perfect what I have merely hinted at in this discussion. Two Spanish engineers, MM. *Le Maur*, drew up superb plans of the canal *de los Guines*, projected for traversing the whole island of *Cuba*, from *Batabano* to the *Havannah*. A similar survey of the isthmus of *Guasacualco*, the lake Nicaragua, of the country between *Cruces* and *Panama*, and between *Cupica* and the *Rio Naipi*, would direct the statesman in his choice, and enable him to decide if it is at Mexico or Darien that this undertaking should be executed; an undertaking calculated to immortalize a government occupied with the true interests of humanity.

The long circumnavigation of South America would then be less frequent; and a communication would be opened for the goods which pass from the Atlantic Ocean to the South Sea. The time is past* "when Spain, through a jealous policy, refused to other nations a thoroughfare through the possessions of which she so long kept the world in ignorance." Those who are at present at the head of the government

* M. de *Fleurieu*, in his learned notes on the *Voyage de Marchand*. T. I. p. 566

BOOK II.

GENERAL POPULATION OF NEW SPAIN. DIVISION OF THE INHABITANTS INTO CASTS.

CHAPTER IV.

General enumeration in 1793. Progress of the population in the ten following years. Proportion of births to burials.

The physical view which we have been rapidly sketching proves, that in Mexico, as elsewhere, nature has very unequally distributed her benefits. But men, unable to appreciate the wisdom of this distribution, neglect the riches which are within their reach. Collected together on a small extent of territory, in the centre of the kingdom, on the very ridge of the Cordillera, they have allowed the regions of the greatest fertility, and the nearest to the coast, to remain waste and uninhabited.

The population of the United States is concentrated in the Atlantic division, that is to say, the long and narrow district between the sea and the Alleghany mountains. In the *capitania general* of Caraccas, the only inhabited and well cultivated districts are those of the maritime regions: in Mexico improvement and civilization are banished into the interior of the country. In this the Spanish conquerors have merely trod in the steps of the conquered nations. The Aztecs, originally from a country to the north of the Rio Gila, perhaps even emigrants from the most

northern parts of Asia, in their progress towards the south never quitted the ridge of the Cordillera, preferring these cold regions to the excessive heat of the coast.

That part of Anahuac which composed the kingdom of Montezuma on the arrival of Cortez did not equal in surface the eighth part of the present kingdom of New Spain. The kings of Acolhuacan, Tlacopan, and Michuacan, were independent princes. The great cities of the Aztecs, and the best cultivated territories were in the environs of the capital of Mexico, particularly in the fine valley of Tenochtitlan. This alone was a sufficient reason to induce the Spaniards to establish there the centre of their new empire; but they loved also to inhabit plains whose climate resembled that of their own country, and where they could cultivate the wheat and fruit trees of Europe. Indigo, cotton, sugar and coffee, the four great objects of West-Indian commerce, were to the conquerors of the sixteenth century of very inferior interest; they sought after the precious metals only with avidity, and the search for these metals fixed them on the ridge of the central mountains of New Spain.

It is equally difficult to estimate with any degree of certainty the number of inhabitants of the kingdom of Montezuma, as to ascertain the ancient population of Egypt, Persia, Greece, or Latium. The extensive ruins of towns and villages observed in Mexico under the 18° and 20° of latitude, undoubtedly prove that the former population of that part of the kingdom was much greater than the present. This interesting fact is confirmed by the letters from Cortez to Charles the Fifth, the memoirs of Bernal Diaz, and a great number of other historical monuments.* But when we reflect how difficult it is even

* See the judicious observations of the Abbé Clavigero on

in our days to acquire accurate statistical information, we need not be astonished at the ignorance in which we are left by the authors of the sixteenth century, as to the ancient population of the West Indies, Peru, and Mexico. We see in history, on the one hand, conquerors eager to make the most of the fruit of their exploits; and the Bishop of Chapa and a small number of benevolent men, on the other, employing, with a noble ardour, the arms of eloquence against the cruelty of the first colonists. All parties were equally interested in exaggerating the flourishing state of the three newly discovered countries. The fathers of St. Francis boasted of having alone baptized from the year 1524 to 1540 more than six millions of Indians, and what is more, of Indians who merely inhabited the parts most adjacent to the capital.

A striking example may serve to show us how circumspect we ought to be in yielding implicit faith in the numbers found in the old descriptions of America. It has recently been printed,* that in the enumeration of the inhabitants of Peru, made by the archbishop of Lima, Fray Geronimo de Loaysa, in 1551, were found 8,285,000 Indians. This is an afflicting fact for those who know that in 1793, on a very exact enumeration ordered by Gil-Lemos, the viceroy, the Indians of the present Peru (since the separation of Chili and Buenos Ayres) did not exceed 600,000 individuals. Here we might be tempted to believe that 7,600,000 Indians had disappeared from the face of the globe. Luckily, however, the assertion of the Peruvian author is entirely false; for on the most careful investigation of the archives of Lima

the ancient population of Mexico, directed against Robertson and Pauw. *Storia antica di Messico*, t. IV. p. 282.

* *Relacion de la ciudad de Truxillo por el Doctor Feyjoo*, 1763, p. 29.

by Father Cisneros, it has been discovered that the existence of eight millions in 1551 rests on no historical document. M. Feyjoo, the author of the statistical account of Truxillo, has even since declared that this bold assertion was merely founded on a suppositious calculation, from the enumeration of so many ruined towns, since the epoch of the conquest. These ruins appeared to him demonstrative of an immense population in Peru at a remote period. It frequently happens, however, that the examination of an erroneous opinion leads to some important truth. Father Cisneros, on rummaging in the archives of the sixteenth century, discovered that the viceroy Toledo, very justly regarded as the Spanish legislator of Peru, reckoned in 1575, in the examination of the kingdom which he made in person from Tumbez to Chuquisagua, (which is nearly the present extent of Peru,) only about a million and a half of Indians.

Nothing in general is more vague than the judgment which we form of the population of a newly discovered country. The celebrated Cook estimated the number of inhabitants of Otaheité at 100,000; the protestant missionaries of Great Britain suppose a population of 49,000 souls; Captain Wilson reduces it to 16,000; and M. Turnbull has attempted to prove that the real number of inhabitants does not exceed 5,000. I cannot allow myself to believe that these differences are the effect of a progressive depopulation. The maladies with which the civilized nations of Europe infected these once happy countries, must, no doubt, have caused a depopulation; but it could never have been so rapid as to carry off in forty years nineteen-twentieth parts of the inhabitants.*

* Captain Cook may have somewhat exaggerated the number of inhabitants of Otaheité; but when we consider that he did not form his estimate so much from conjectural circumstances as from having seen the whole population of the island, drawn to the coast by the novel appearance of the

We have already mentioned that the environs of the capital of Mexico, and perhaps all the countries under the domination of Montezuma, were probably much more populous formerly than at present;* but this great population was concentrated in a very small space. We observe (and the observation is consoling for humanity) that not only has the number of Indians been on the increase for the last century, but that the whole of the vast region which we designate by the general name of New Spain is much better inhabited at present than it was before the arrival of the Europeans. The first of these assertions is proved by the state of the capitation which we shall afterwards give, and the last is founded on a very simple consideration. In the beginning of the sixteenth century, the Otomites, and other barbarous people, occupied the countries situated to the north of the rivers Panuco and Santiago; but since an improved cultivation of the soil and civilization have advanced towards New Biscay and the *provincias internas*, the

strangers, pass, as it were, in review before him, we shall be perhaps rather inclined to acquiesce in this estimate. We shall be the more induced to this when we consider how near soldiers or sailors, accustomed to form rapid estimates of the numbers of masses of men, often approach to the truth. Besides, Captain Cook was in general extremely sober and moderate in his judgments.

That the population, then, has declined prodigiously is almost certain; and it is no less certain, that whatever produced the physical alteration in the inhabitants related by Vancouver, must have contributed in no small degree to the decline. This navigator, as is well known, twice visited the island. In the first voyage when he accompanied Cook, the beauty of the inhabitants, particularly the females, was universally remarked; but in the last voyage, in which were several of those who had been, as well as Vancouver, of the former, they all agreed that the appearance of the people was totally changed, and they did not discover a single woman in the island who was not deformed and ugly. *Trans.*

* Clavigero, *Storia antica di Messico*, t. I. p. 36.

population has increased there with the rapidity every where remarked where a nation of shepherds is replaced by agricultural colonists.*

Politico-economical investigations, grounded on exact numbers, were very unusual in Spain even before Campomanes, and the minister Count Florida Blanca. We are not then to be astonished that the archives of the viceroyalty of Mexico contain no enumeration before 1794, when the Count de Revillagigedo, one of the wisest and most active administrators, had resolution enough to undertake it. In the operations regarding the population of Mexico, by order of the viceroy Pedro Cebrian Count de Fuenclara, in 1742, the number of families only was estimated; and what has been preserved to us by Villa Senor, is both incomplete and inaccurate. Those who know the difficulties of an enumeration in the most cultivated countries of Europe, who know that the economists assigned only eighteen millions of inhabitants to all France, and that it has been even recently disputed if the true population of Paris† were 500,000 or 800,000, will easily imagine what powerful obstacles are to be overcome in a country, where those who are employed are little skilled in such kind of statistical researches. Hence the viceroy Revillagigedo was unable to terminate his undertaking; and it appears that the enumeration was not completed in the two intendancies of Guadalaxara and Vera Cruz, and in the small province of Cohahuila.

* The author may be very probably in the right; yet it is but an indifferent proof that the population of the whole kingdom has increased, because, in those places where shepherds have given place to agriculturists, the population has been rapidly increasing. By a similar mode of reasoning, it may be concluded that the population of Britain is on the decline, because the population of the highlands of Scotland, converted from agriculture to sheep farming, is on the decline. *Trans.*

† La population habituelle de cette grande capitale paroît être de 547,000 habitans. *Peuchet*, Stat. de la France, p. 93

The following is a state of the population* of New Spain, from the notices transmitted by the intendants and governors of provinces to the viceroy, previous to the 12th May, 1794:

Names of the intendancies and governments in which the enumeration was completed in 1793.		POPULATION. Of the intendancies and governments.	Of the capitals.
Mexico		1,162,886	112,926
Puebla		566,443	52,717
Tlascala		59,177	3,357
Oaxaca		411,366	19,069
Valladolid		289,314	17,093
Guanaxuato		397,924	32,098
San Luis Potosi		242,280	8,571
Zacatecas		118,027	25,495
Durango		122,866	11,027
Sonora		93,396	
Nuevo Mexico		30,953	
The two Californias		12,666	
Yucatan		358,261	28,392
Total population of New Spain deduced from the enumeration of 1793		3,865,529	
In a report to the king, Count de Revillagigedo estimated the intendancy of Guadalaxara at	Inhabitants. 485,000		
Intendancy of Vera Cruz at	120,000	618,000	
Province of Cohahuila at	13,000		
Approximative result of the enumeration in 1793		44,83,529 inhabitants.	

*I publish this state from a copy preserved in the archives of the viceroy. I observed that other copies in circulation in the country contain different numbers; for example, 638,771 souls for the intendancy of la Puebla, including the ancient republic of Tlascala.

This result exhibits the minimum of population admissible at the period. The central government, particularly the administrations spread over the interior of the country, soon perceived how far they were from the end which they had in view. In the new continent, as well as in the old, every enumeration is considered by the people as a sinister presage of some financial operation. In the fear of an augmentation of imposts, every head of a family endeavoured to diminish the number of individuals of his house, of which he was to furnish a list. The truth of this assertion is very easily demonstrable. Before the enumeration of the Count de Revillagigedo, the capital of Mexico, for example, was believed to contain 200,000 inhabitants. This estimate might be exaggerated; but the tables of consumption, the number of births and burials, and the comparison of these numbers with those of the great cities of Europe, all tended to prove that the population of Mexico exceeded at least 135,000 souls; and yet the table printed by order of the viceroy in 1790, exhibits only 112,926. In smaller cities, easier to be controlled, the error was still more considerable. Those also who followed in detail the dissection of the registers of 1793, judged that the number of inhabitants who had withdrawn themselves from the general enumeration could by no means be compensated by those, who, wandering about without any fixed domicil, had been several times included in it. It was supposed that a sixth or a seventh part ought at least to be added to the sum total, and the population of all New Spain was accordingly estimated at 5,200,000 souls.

The viceroys who succeeded to the Count de Revillagigedo have never renewed the enumeration; and since that time, the government has paid very little attention to statistical researches. Several memoirs drawn up by intendants on the actual state of

the country confided to their care contain exactly the same number as the table of 1793, as if the population could have remained the same for ten years. It is certain, however, that this population has made the most extraordinary progress. The augmentation of tithes and of the Indian capitation, and of all the duties on consumption, the progress of agriculture and civilization, the aspect of a country covered with newly constructed houses, announce a rapid increase in every part of the kingdom. How are we to conceive then that social institutions can be so defective, and a government so iniquitous, as to pervert the order of nature, and prevent the progressive multiplication of our species in a fertile soil and temperate climate? Happy the portion of the globe where a peace of three centuries has almost effaced the very recollection of the crimes produced by the fanaticism and insatiable avarice of the first conquerors!

In order to draw up a table of the population in 1803, and to exhibit numbers as near to the truth as possible, it was necessary to augment the result of the last enumeration: 1. With that part of the inhabitants omitted to be entered in the lists; and, 2. With the excess of the births above the burials. I wished rather to adopt a number below the actual population, than to hazard suppositions which might appear extravagant. I have therefore lowered the estimated number of inhabitants omitted in the general census, and in place of a sixth adopted a tenth.

As to the progressive augmentation of the population since 1793 to the epoch of my journey, I have fixed it from sufficient data. Through the particular kindness with which I was honoured by a respectable prelate, the present Archbishop of Mexico,* I was

* Don Francisco Xavier de Lizana. I am also indebted for very important documents to Don Pedro de Fonte, provisor of the archbishopric. See note B, at the end of the work.

enabled to enter into minute investigations on the relation between the births and deaths, according to the difference of climates of the central table-land and the regions adjacent to the coast. Several parish priests, (*curés*,) interested in the solution of so important a problem as the augmentation or diminution of our species, engaged in a very laborious undertaking. They communicated to me the number of baptisms and burials, yearly, from 1752 to 1802; and from the whole of these minute registers, which I have preserved, it appears that the proportion of the births to the deaths is nearly as 170 : 100. I shall merely here adduce a few examples to confirm this assertion; and they are so much the more interesting as we have yet no statistical data on the relation of the deaths to the births under the torrid zone.

In the Indian village of Singuilucan, eleven leagues north from the capital, there were, from 1750 to 1801, in all, 1,950 deaths, and 4,560 births: inde, excess of deaths 2,610.

In the Indian village of Axapuzco, thirteen leagues north from Mexico, there were, from the period when this village was separated from the parish of Otumba, i. e. from 1767 to 1797, in all, 3,511 deaths, and 5,528 births; consequently excess of the births, 2,017.

In the Indian village of Malacatepec, twenty-eight leagues west from the valley of Tenochtitlan, there were, between 1752 and 1802, in all, 13,734 births, and 10,529 deaths. Excess of births 3,205.

In the village of Dolores, from 1756 to 1801, there were, in all, 24,123 deaths, and 61,258 births; hence the extraordinary excess of 37,135 births.

In the city of Guanaxuato, there were, from 1797 to 1802, 12,666 births, and 6,294 deaths; or an excess of 6,372 births.

In the village of Marfil, near Guanaxuato, there were in the same space of time 3,702 births, and 1,904 deaths; or an excess of 1,798 births.

In the village of St. Anne, near Guanaxuato, there were in five years 3,629 births, and 1,857 deaths, consequently an excess of 1,772 births.

At Yguala, a village situated in a very warm valley near Chilpansingo, there were, during ten years, 3,373 births, and 2,395 deaths, or an excess of 978 births.

In the Indian village Colimaya, situated on a very cold plain, there were, during ten years, 5,475 births, and 2,602 deaths, or an excess of 2,673 births.

In the jurisdiction of the city of Queretaro, there were, in 1793, 5,064 births in all, and 2,678 deaths, or an excess of 2,386 births.

These examples prove that the relation of the deaths to the births is very different according to the climate and salubrity of the air. It is,

At Dolores	= 100 : 253
Singuilucan	= 100 : 234
Calimaya	= 100 : 202
Guanaxuato	= 100 : 201
Sta. Ana	= 100 : 195
Marfil	= 100 : 194
Queretaro	= 100 : 188
Axapuzco	= 100 : 157
Yguala	= 100 : 140
Malacatepec	= 100 : 134
Panuco	= 100 : 123

The mean term of these eleven places would be 100 to 183; but the proportion which may be regarded as suitable for the whole population appears to me to be 100 : 170. In the United States of America, it is as 100 : 201.

It appears that on the high plain of the Cordillera, the excess of births is greater than towards the coast, or in the very warm regions. What a difference between the villages of Calimaya and Yguala! At Panuco, where the climate is as hot as at Vera Cruz,

although the mortal disease of *black vomiting* has never yet been known there, the number of births from 1793 to 1802 was 1,224, and the number of deaths, 988; so that we have here the unfavourable proportion of 100 to 123. Hindostan and South America, particularly the province of Cumana, the coast of Coro and the plains (*llanos*) of Caraccas, sufficiently prove that heat alone is not the cause of this great mortality. In climates very warm, and at the same time very dry, the human species enjoys a longevity perhaps greater than what we observe in the temperate zones. This is especially the case whenever the temperature and climate are excessively variable. The Europeans who transport themselves at an age somewhat advanced into the equinoxial part of the Spanish colonies attain there for the most part to a great and happy old age. At Vera Cruz, in the midst of the epidemical *black vomitings*, the natives and strangers seasoned for several years to the climate enjoy the most perfect health.

In general, the coasts and arid plains of equatorial America should be looked upon as healthy, notwithstanding the excessive heat of the sun, whose perpendicular rays are reflected by the soil. Individuals come to maturity, particularly those who approach to old age, have little to fear from these regions, of which the unhealthiness has been unjustifiably exaggerated. The chief mortality is among the children and young people, particularly in those parts where the climate is at once very warm and very humid. Intermittent fevers prevail all along the coast from Alvarado to Tamiagua, Tampico, and even to the plains of New Santander. The western declivity of the Cordillera of Mexico, and the shores of the South Sea, from Acapulco to the ports of Colima and San Blas, are equally unhealthy. We may compare this humid, fertile and unhealthy territory to the maritime part of the province of Caraccas, from New Barcelona

to Porto Cabello. Tertian fevers are the scourge of these countries, adorned by nature with the most vigorous vegetation, and rich in every useful production. This scourge is so much the more cruel, as the natives abandon in the most shocking manner all those who are affected. The children especially fall victims to this neglect of the Indians. In these hot and humid regions, the mortality is so great that the population makes no sensible progress; while in the cold regions of New Spain (and these regions compose the greatest part of the kingdom) the proportions of the births to the deaths is as 190 to 100, or even as 200 to 100.

The proportion of the births and deaths to the population is more difficult to estimate than even the proportion between the births and deaths. In countries where the laws tolerate only one religion, and where the priest (*curé*) draws a part of his revenues from the baptisms and burials, we may know exactly enough the excess of the births above the deaths; but the number which expresses the relations of the deaths to the whole population is effected by a part of the uncertainty which envelopes the population itself. In the town and territory of Queretaro, the population is reckoned at 70,600. If we divide this number by 5,064 births and 2,678 deaths, we shall find that for every fourteen persons one is born, and that for every twenty-six one dies. At Guanaxuato, including the adjacent mines of St. Anne and Marfil, in a population of 60,100, there are *communibus annis* (assuming the mean term of five years) 3,998 births and 2,011 deaths. For every fifteen, then, one is born, and every twenty-nine one dies. The relation of the births or deaths to the whole population is in Europe much less favourable to the augmentation of the species. In France, for example, the births are as one to 28 3-10, and the deaths as one to 30 9-10. This is the precise result deduced by M. *Peuchet* from

the tables of births, marriages, and deaths, drawn up in the year nine, in 98 departments, by order of the minister of the interior. Farther north, in the Prussian monarchy, there were, in 1802, for nine millions of inhabitants, 436,616 births, and 282,109 deaths: hence the births are one in 20 and the deaths one in 32. But in Sweden, a country less favoured by nature, according to the tables of M. *Nicander*, the most exact and extensive that were ever drawn up, the births are one in 30, and the deaths one in 39.

It appears, in general, that in the kingdom of New Spain the proportion of the births to the population is one in 17, and of the deaths one in 30. We may estimate the present number of births at nearly 350,000, and the deaths at 200,000. This excess of births in favourable circumstances, that is to say, in years without famine, epidemical small-pox, or *matlazahuatl*, the most mortal disease of the Indians, is nearly 150,000. In general, we observe everywhere on the globe that the population augments with a prodigious rapidity in countries still thinly inhabited, with an eminently fertile soil, a soft and equal temperature, and particularly where there is a robust race of men incited by nature to marriage at a very early age.

The parts of Europe in which cultivation only commenced in the last half of the past century afford very striking examples of this excess of births. In West Prussia there were in 1784, in a population of 560,000 inhabitants, 27,134 births, and 15,669 deaths. These numbers give the proportion of births to deaths 36 to 20, or 180 : 100, a proportion equally favourable with that of the Indian villages situated in the central plain of Mexico. In the Russian empire, in 1806, the births amounted to 1,361,134, and the deaths to 818,433. The same causes everywhere produce the same effects. The newer the cultivation of a country is, so much the easier is sub-

sistence on a soil newly torn up, and consequently so much more rapid the progress of population. To confirm this thesis, we have only to cast our eyes over the proportions of the births to the deaths in the following table.

In France	= 110 : 100
England*	= 120 : 100
Sweden	= 130 : 100
Finland	= 160 : 100
Russian empire	= 166 : 100
West Prussia	= 180 : 100
Government of Tobolsk, according to M. *Hermann*	= 210 : 100
Several places in the table-land of Mexico	= 230 : 100
United States (State of New Jersey)	= 300 : 100

The data which we have taken for the proportion of the births to the deaths, and of both to the whole population, prove that if the order of nature were not inverted from time to time by some extraordinary cause, the population of New Spain would double every nineteen years.† In a period of ten years it should have augmented 44-100. In the United States we have seen the population double, since 1784,

* Essay on the Principles of Population, by Mr. Malthus, one of the most profound works in political economy which has ever appeared.

† Let p represent the actual population of a country, n the proportion of the population to the births, d the proportion of the deaths to the births, and k the number of years at the end of which it is wished to estimate the population, we shall have the state of the population at the epoqua k, expressed by $p\,(1+n\,(1-d))^{k}$; so that if we would know in how many years the population doubles, this number of years will be expressed by $k = \frac{\log.\ 2.}{\log.\ (1+n\,(1-d))}$

every twenty or twenty-three years. The curious tables published by Mr. Samuel Blodget in his *Statistical Manuel for the United States of America*, (1806,) show that in some states this happy cycle is only thirteen or fourteen years. In France the population would double in the space of 214 years, if no war or no contagious disease were to diminish the annual excedent of the births. Such is the difference between countries already very populous, and those which have yet but a nascent industry.

The only true sign of a real and permanent increase of population is an increase in the means of subsistence. This increase, this augmentation of the produce of agriculture, is evident in Mexico; and appears even to indicate a much more rapid progress of population than has been supposed, in deducing the population of 1803 from the imperfect enumeration of 1793. In a catholic country, the ecclesiastical tenths are, as it were, the thermometer by which we may judge of the state of agriculture; and these tenths, as we shall afterwards state, have doubled in less than 24 years.

All these considerations suffice to prove that in admitting 5,800,000 inhabitants for the kingdom of Mexico at the end of the year 1803, I have taken a number, which, far from being exaggerated, is probably *much below the existing population*. No public calamity has afflicted the country since the enumeration of 1793. If we add, 1st, a tenth for the individuals not included in the enumeration, and, 2d, two tenths for the progress of population in ten years, we suppose an excess of births which is less by one half than the result of the parish registers. According to this supposition the number of inhabitants would double every 36 or 40 years. Yet well informed persons who have attentively observed the progress of agriculture, increase of villages and cities, and the augmentation of all the revenues of the crown

depending on the consumption of commodities, are tempted to believe that the population of Mexico has made a much more rapid progress. I am far from pronouncing on so delicate a matter: it is enough for me to have exhibited a detail of the materials hitherto collected, which may lead to accurate results. I consider it as extremely probable, that the population of Mexico in 1808 exceeds 6,500,000. In the Russian empire, of which the political and moral state bears, in many respects, a strong analogy to the country we are describing, the increase of population from the excess of births is much more rapid than what we admit for Mexico. According to the statistical work of M. *Hermann*, the enumeration of 1763 gave 14,726,000 souls. The result of that made in 1783 was nearly 25,677,000; and the total population of Russia in 1805 was estimated at 40,000,000. Yet what obstacles does not nature oppose to the progress of population in the most northern parts of Europe and Asia! And what a contrast between the fertility of the Mexican soil, enriched with the most precious vegetable productions of the torrid zone, and the sterility of plains for more than half the year buried under ice and snow.

CHAPTER V.

Maladies which periodically arrest the progress of population. Small-pox, natural and inoculated. Cow-pox. Matlazahuatl. Famine. Health of miners.

It remains for us to examine into the physical causes which almost periodically arrest the progress of Mexican population. These causes are the small-pox, the cruel malady called by the Indians *Matla-*

zahuatl, and especially famine, of which the effects are felt for a long time.

The small-pox, introduced since 1520, appears only to exercise its ravages every seventeen or eighteen years. In the equinoxial regions it has, like the *black vomiting* and several other diseases, its fixed periods, to which it is very regularly subjected. We might say that in these countries the disposition for certain miasmata is only renewed in the natives at long intervals; for though the vessels from Europe frequently introduce the germ of the small-pox, it never becomes epidemical but after very marked intervals; a singular circumstance, which renders the disease so much the more dangerous for adults. The small-pox committed terrible ravages in 1763, and especially in 1779, in which year it carried off in the capital of Mexico alone more than nine thousand persons. Every evening tumbrels passed through the streets to receive the corpses, as at Philadelphia during the yellow fever. A great part of the Mexican youth was cut down that year.

The epidemic of 1797 was less destructive, chiefly owing to the zeal with which inoculation was propagated in the environs of Mexico, and in the bishopric of Mechoachan. In the capital of this bishopric the city of Valladolid, of 6,800 individuals inoculated, only 170, or 2 1-2 per cent. died; and we must also observe, that several of those who perished were inoculated at a time when they were probably already infected in the natural manner. Fifteen in the hundred died of individuals of all ages, who without being inoculated were victims of the natural small-pox. Several individuals, particularly among the clergy, displayed at that period a very praiseworthy patriotism, in arresting the progress of the disease by inoculation. I shall merely mention the names of two enlightened men, M. de Reano, intendant of Gua-

Guanaxuato, and Don Manuel Abad, penitentiary canon of the cathedral of Valladolid, whose generous and disinterested views were constantly directed towards the public good. There were then inoculated in the kingdom between 50 and 60,000 individuals.

But in the month of January, 1804, the vaccine inoculation was even introduced at Mexico through the activity of a respectable citizen, Don Thomas Murphy, who brought several times the virus from North America. This introduction found few obstacles; the cow-pox appeared under the aspect of a very trivial malady; and the small-pox inoculation had already accustomed the Indians to the idea that it might be useful to submit to a temporary evil for the sake of evading a greater evil. If the vaccine inoculation, or even the ordinary inoculation, had been known in the new world in the sixteenth century, several millions of Indians would not have perished victims to the small-pox, and particularly to the absurd treatment by which the disease was rendered so fatal. To this disease the fearful diminution of the number of Indians in California is to be ascribed. The ships of war commissioned to carry the vaccine matter into America and Asia arrived at Vera Cruz shortly after my arrival.

Don Antonio Valmis, physician general of this expedition, visited Portorico, Cuba, Mexico, and the Philippine islands; and his stay at Mexico, where nevertheless the cow-pox was known before his arrival, contributed singularly to facilitate the propagation of this salutary preservative. In the principal cities of the kingdom vaccine committees were formed, (*juntas centrales*,) composed of the most enlightened individuals, who, by vaccinating monthly, preserve the miasma from being lost. It is so much the less liable to be lost, as it exists in the country. M. *Valmis* discovered it in the environs of Valladolid, and in the village of Atlisco, near la Puebla, in the

of the Mexican cows. The commission fulfilled the beneficent views of the king in, we may indulge a hope that through the ie of the clergy, and especially of the religous onaries, vaccination will be gradually introduced the very interior of the country. The voyage of Valmis will thus remain for ever memorable in annals of history. The Indies saw for the first e those vessels, which were formerly freighted y with instruments of carnage and destruction, aring about the germ of relief and consolation to stressed and suffering humanity.

The arrival of the armed frigates in which M. Valmis made the circuit of the Atlantic and Pacific Oceans gave rise on several coasts to one of the most simple, and therefore most affecting, ceremonies. The bishops, military governors, and persons of greatest distinction, repaired to the shore, where they took in their arms the children who were to carry the cow-pox to the indigenous Americans and the Malays of the Philippine islands, and, followed with public acclamations, they laid at the foot of the altar those precious preservative deposits, returning thanks to the Supreme Being for having been the witnesses of so happy an event. We must have some knowledge of the ravages occasioned by the small-pox in the torrid zone, and especially among a race of men whose physical constitution seems adverse to cutaneous eruptions, in order to feel all the importance of M. Jenner's discovery. It is a much greater blessing for the equinoxial part of the new continent than for the temperate climate of the old.

It may be useful to relate here a fact of some importance for those who take an interest in the progress of vaccination. It was unknown at Lima till the month of November, 1802. At that period the small-pox prevailed on the coast of the South Sea. A merchant vessel, *Santo Domingo de la Calzada*, put

into Lima in the passage from Spain to Manilla. An individual had had the good sense to send by this vessel vaccine matter to the Philippine islands. They availed themselves of this opportunity at Lima; and M. Unanue, professor of anatomy, and author of an excellent physiological treatise on the climate of Peru,* vaccinated several individuals by means of the matter brought by the merchant vessel. No pustule appeared; and the virus appeared either altered or too weak. However, M. Unanue having observed that all the vaccinated individuals had a very mild small-pox, employed this variolous matter to render, if possible, by the ordinary inoculation, the disease less fatal. He thus perceived in an indirect way the effects of a vaccination supposed to have failed.

It was accidently discovered in the course of the same epidemic in 1802, that the beneficent effect of vaccination had been long known to the country people among the Peruvian Andes. A negro slave had been inoculated for the small-pox in the house of the Marquis de Valleumbroso who showed no symptom of the disease. They were going to repeat the inoculation, when the young man told them that he was certain of never having the small-pox, because in milking cows in the Cordillera of the Andes he had had a sort of cutaneous eruptions, caused, as the Indian herdsmen said, by the contact of certain tubercles sometimes found on the udders of cows. Those who have had this eruption, said the negro, never take the small-pox. The Africans, and especially the Indians, display great sagacity in observing the character, habits, and diseases of the animals

* This work, which displays an intimate acquaintance with the French and English literature, bears the title of *Observaciones sobre el clima de Lima y sus influencias en los seres organizados en especial el hombre, por el Dr. D. Hipolito Unanue.* Lima, 1806.

with which they live. We need not therefore be astonished, that, on the introduction of horned cattle into America, the lower people remarked that the pustules on the udders of cows communicated to the herdsmen a species of benignant small-pox, and that those once infected are secure from the general contagion during the epochs when the disease is epidemical.

The *matlazahuatl*, a disease peculiar to the Indian race, seldom appears more than once in a century. It raged in a particular manner in 1545, 1576, and 1736. It is called a plague by the Spanish authors. As the latest epidemic took place at a time when medicine was not considered a science, even in the capital, we have no exact data as to the *matlazahuatl*. It bears certainly some analogy to the yellow fever or black vomiting; but it never attacks white people, whether Europeans or descendants from the natives. The individuals of the race of Caucasus* do not appear subject to this mortal typhus, while, on the other hand, the yellow fever or black vomiting very seldom attacks the Mexican Indians. The principal site of the *vomito prieto* is the maritime region, of which the climate is excessively warm and humid; but the *matlazahuatl* carries terror and destruction into the very interior of the country, to the central table-land, and the coldest and most arid regions of the kingdom.

Father Torribio, a Franciscan, better known by his Mexican name of Motolinia, asserts that the small-

* Who are the individuals of the race of Caucasus? The Europeans. So at least we learn from the context where they are opposed to the Mexican Indians. This involves the theory of the mountains of Asia being the nursery of the old continent. Every one, however, will not so easily be able to understand Europeans by this denomination. Such attempts to elevate the style, at the expense of perspicuity, can never enough be reprobated. *Trans.*

pox, at its introduction in 1520, by a negro slave of Narvaez, carried off the half of the inhabitants of Mexico. Torquemada advances the hazardous opinion, that in the two *matlazahuatl* epidemics of 1545 and 1576, 800,000 Indians died in the former, and 2,000,000 in the latter. But when we reflect on the difficulty with which we can at this day estimate, in the eastern part of Europe, the number of those who fall victims to the plague, we shall very reasonably be inclined to doubt if the viceroys Mendoza and Almanza, governors of a recently conquered country, were able to procure an enumeration of the Indians cut off by the *matlazahuatl*. I do not accuse the two monkish historians of want of veracity; but there is very little probability that their calculation is founded on exact data.

A very interesting problem remains to be resolved. Was the pest, which is said to have desolated from time to time the Atlantic regions of the United States before the arrival of the Europeans, and which the celebrated Rush and his followers look upon as the principle of the yellow fever, identical with the *matlazahuatl* of the Mexican Indians? We may hope that this last disease, should it ever reappear in New Spain, will be hereafter carefully observed by the physicians.

A third obstacle to the progress of population in New Spain, and perhaps the most cruel of all, is famine. The American Indians, like the inhabitants of Hindostan, are contented with the smallest quantity of aliment on which life can be supported, and increase in number without a proportional increase in the means of subsistence. Naturally indolent, from their fine climate and generally fertile soil, they cultivate as much maize, potatoes, or wheat, as is necessary for their own subsistence, or at most for the additional consumption of the adjacent towns and

mines. Agriculture, it is true, has made great progress within the last twenty years; but the consumption has also increased in an extraordinary manner from the augmentation of population, and an excessive luxury formerly unknown to the mixed casts, and from the working of a great number of new seams, which require additional men, horses, and mules. Few hands, no doubt, are employed in manufactures in New Spain; but a great number are withdrawn from agriculture from the necessity of transporting on mules goods and the produce of the mines, iron, powder, and mercury from the coast to the capital, and from thence to the mines along the ridges of the Cordilleras.

Thousands of men and animals pass their lives on the great roads between Vera Cruz and Mexico, Mexico and Acapulco, Oaxaca and Durango, and the cross roads by which provisions are carried to the habitations established in arid and uncultivated regions. This class of inhabitants, called by the economists in their system, sterile and non-productive, is consequently more numerous in America than might be expected in a country where manufacturing industry is yet so little advanced. The want of proportion between the progress of population and the increase of food from cultivation renews the afflicting spectacle of famine, whenever a great drought or any other local cause has damaged the crop of maize. Scarcity of provisions has always been accompanied in all times and all parts of the globe with epidemical diseases fatal to population.* The

* This position requires qualification. Dr. Smith has, I believe, well remarked, that in years of scarcity there are, perhaps, fewer diseases and deaths than usual, from the diminished consumption of spirituous liquors by the common people, one of the most productive sources of disease. The position will undoubtedly, however, hold with regard to a

want of nourishment in 1784 gave rise to *asthenical* diseases among the most indigent class of the people. These accumulated calamities cut off a great number of adults, and a still greater number of children; and it was computed that in the town and mines of Guanaxuato more than 8,000 individuals perished. A very remarkable meteorological phenomenon contributed principally to the scarcity; the maize, after an extraordinary drought, was nipt by frost on the night of the 28th August, and, what is more singular, at an elevation of 1,800 metres.* The number of inhabitants carried off by this fatal union of famine and disease throughout the whole surface of the kingdom, was estimated at more than 300,000. This number will appear the less astonishing to us when we consider, that even in Europe the population is sometimes diminished by scarcity more than it is augmented by the excess of births above the deaths for four consecutive years. There perished in Saxony, for example, in 1772, near 66,000 inhabitants, while the excess of births above the deaths, was not, *communibus annis*, from 1764 to 1784, more than 17,000.†

Hindoo or Indian population, who in years of plenty have no more than merely supports animal life, and to whom, therefore, any reduction always proves fatal. *Trans.*

* 5,904 feet. *Trans.*

† The translator is afraid that this number of 66,000 includes the whole deaths of Saxony in 1772, in which case the statement that the diminution of population from the famine exceeded the augmentation from the excess of births for four consecutive years will fall to the ground. Every one knows that it is impossible to state exactly the number of deaths from famine in any country, as literally few or none die of famine, but of diseases occasioned by a defective diet, which can never be separated in any bill of mortality from diseases owing to other causes. The nearest approximation, however, is to be found by deducting the average mortality from the increased mortality in any given year of scarcity. I think it extremely probable, that M. de Humboldt has not adopted this me-

The effects of famine are common to almost all the equinoxial regions. In the province of New Andalusia, in South America, I have seen villages whose inhabitants were forced by famine to disperse themselves from time to time in the deserts to pick up a subsistence from the wild plants. In vain the missionaries employ their authority to prevent this dispersion. In the province *de los Pastos*, the Indians when the potatoes fail, which are their principal nourishment, repair sometimes to the most elevated ridge of the Cordillera to subsist on the juice of the achupallas, a plant related to the genus pitcarnia. The Otomacks at Uruana, on the banks of the Orino, swallow, during several months, potter's earth, to absorb by this load the gastric juice, and to satisfy in some sort, the hunger which torments them.* In the islands of the South Sea, in a fertile soil, where nature has lavished all her blessings, the inhabitants are frequently driven by famine to devour one another. Under the torrid zone, where a beneficent hand seems everywhere to have scattered the germs of abundance, man, careless and phlegmatic, experiences periodically a want of nourishment which the industry of more civilized nations banishes from the most sterile regions of the north.

The working of the mines has long been regarded as one of the principal causes of the depopulation of America. It will be difficult to call in question, that at the first epoch of the conquest, and even in

thod. He elsewhere states, that the adjacent country Prussia had, in 1802, on a population of nine millions, 282, deaths. If we take Mr. Pinkerton's estimate of the Sa population, 2,104,000, say, however, 2,000,000, and assum mortality for it proportionate to that of Prussia, we shall f the number of deaths 62,869. If, supposing then 66,000 mortality of 1772, and 62,869 the average mortality, the crease by famine in 1772 would only be 3,311. This is a m more likely number than the enormous one given by M. Humboldt; but the fact can easily be ascertained. *Trans.*

* See my *Tableaux de la Nature*, t. I. p. 62. 191. and 209.

seventeenth century, many Indians perished from the excessive labour to which they were compelled in the mines. They perished without posterity, as thousands of African slaves annually perish in the West-Indian plantations from fatigue, defective nourishment, and want of sleep. In Peru, at least in the most southern part, the country is depopulated by the mines, because the barbarous law of the *mita* is yet in existence, which compels the Indians to remove from their homes into distant provinces, where hands are wanted for extracting the subterraneous wealth. But it is not so much the labour as the sudden change of climate, which renders the mita so pernicious to the health of the Indians. This race of men has not the flexibility of organization for which the Europeans are so eminently distinguished. The health of copper-coloured man suffers infinitely when he is transported from a warm to a cold climate, particularly when he is forced to descend from the elevation of the Cordillera into those narrow and humid valleys, where all the miasmata of the neighbouring regions appear to be deposited.

In the kingdom of New Spain, at least within the last thirty or forty years, the labour of the mines is free; and there remains no trace of the *mita*, though a justly celebrated author* has advanced to the contrary. No where does the lower people enjoy in greater security the fruit of their labours than in the mines of Mexico; no law forces the Indians to choose this species of labour, or to prefer one mine to another; and when he is displeased with the proprietor of the mine, he may offer his services to another master who may pay perhaps more regularly. These unquestionable facts are very little known in Europe. The number of persons employed in sub-

* Robertson, History of America, vol. ii. p. 373.

terraneous operations, who are divided into several classes, (*Barrenadores, Faeneros, Tenateros, Bareteros,*) does not exceed in the whole kingdom of New Spain 28 or 30,000. Hence there is not more than 1-200 of the whole population immediately employed in the mines.

The mortality among the miners of Mexico is not much greater than what is observed among the other classes. We may easily be convinced of this by examining the bills of mortality in the different parishes of Guanaxuato and Zacatecas. This is a phenomenon so much the more remarkable, as the miner in several of these mines is exposed to a temperature 6° above the mean temperatures of Jamaica and Pondicherry.* I found the centigrade thermometer at 34°† at the bottom of the mine of Valenciana, [*en los planes,*] a perpendicular depth of 513 metres,‡ while at the mouth of the pit in the open air, the same thermometer sinks in winter to 4° or 5°§ above 0. The Mexican miner is, consequently, exposed to a change of temperature of more than 30°.‖ But this enormous heat of the Valenciana mine is not the effect of a great number of men and lights collected into a small space; it is much more owing to local and geological causes which we shall afterwards examine.

It is curious to observe how the Mestizos and Indians employed in carrying minerals on their back, who go by the name of *Tenateros*, remain continually loaded for six hours with a weight of from 225 to 350 pounds, and constantly exposed to a very high temperature, ascending eight or ten times suc-

* Nearly 11° of Fahrenheit. *Trans.*

† 93° of Fahrenheit. *Trans.* ‡ 1,681 feet. *Trans.*

§ 39° or 41° of Fahrenheit. *Trans.*

‖ 54° of Fahrenheit. *Trans.*

cessively, without intermission, stairs of 1,800 steps. The appearance of these robust and laborious men would have operated a change in the opinions of the Raynals and Pauws, and a number of other authors, however estimable in other respects, who have been pleased to declaim against the degeneracy of our species in the torrid zone. In the Mexican mines, children (*enfans*) of seventeen years of age* are able to carry masses of stone of a hundred pounds weight. This occupation of Tenateros is accounted unhealthy, if they enter more than three times a week into the mines. But the labour which ruins most rapidly the robustest constitutions, is that of the *Barenadores*, who blow up the rock with powder. These men rarely pass the age of 35, if from a thirst of gain they continue their severe labour for the whole week. They generally pass no more than five or six years at this occupation, and then betake themselves to other employments less injurious to health.

The art of mining is daily improving, and the pupils of the school of mines at Mexico gradually diffuse correct notions respecting the circulation of air in pits and galleries. Machines are beginning to be introduced in place of the old method of carrying minerals and water on men's backs up stairs of a rapid ascent. In proportion as the mines of New Spain resemble more and more those of Freiberg, Clausthal, and Schemnitz, the miner's health will be less

* I should be inclined to think that the author meant here to say *enfans de sept à dix ans*, instead of *enfans de dix sept ans*; for *enfant*, it is believed, can hardly be applied with propriety to a youth of 17; and if a full-grown man could ascend eight or ten times, without intermission, 1,800 steps of a stair with 350 pounds, it certainly could not add to the evidence of the strength of this race to say, that a young man of 17 could carry little more than the fourth part of that weight. *Trans.*

injured by the influence of the *Mofettes*,* and the excessively prolonged efforts of muscular motion.

From five to six thousand persons are employed in the amalgamation of the minerals, or the preparatory labour. A great number of these individuals pass their lives in walking barefooted over heaps of brayed metal, moistened and mixed with muriate of soda, sulphate of iron, and oxyd of mercury, by the contact of the atmospheric air and the solar rays. It is a remarkable phenomenon to see these men enjoy the most perfect health. The physicians who practise in places where there are mines unanimously assert, that the nervous affections, which might be attributed to the effect of an absorption of oxyd of mercury, very rarely occur. At Guanaxuato part of the inhabitants drink the very water in which the amalgamation has been purified (*aqua de lavaderos*) without feeling any injury from it. This fact has often struck Europeans not intimately acquainted with the principles of chemistry. The water is at first of a grayish-blue colour, and contains in suspension black oxyd of mercury, and small globules of native mercury and amalgamation of silver. This metallic mixture gradually precipitates, and the water becomes limpid. It can neither dissolve the oxyd of mercury nor the muriate of mercury, which is one of the most insoluble salts which we know. The mules are very fond of this water, because it contains a little muriate of soda in dissolution.

In speaking of the progress of the Mexican population, and of the causes which retard that progress, I have neither mentioned the arrival of new European colonists, nor the mortality occasioned by the *black vomiting*. We shall discuss these subjects in the sequel. It is sufficient to observe here, that the

* The translator professes his ignorance of the meaning of this word.

vomito prieto is a scourge which is never felt but on the coast, and which does not, throughout the whole kingdom, carry off annually more than from two to three thousand individuals. As to Europe, it does not send more than 800 to Mexico. Political writers have always exaggerated what they call the depopulation of the old continent by the new. M. Page,* for example, asserts in his work on the commerce of St. Domingo, that the emigrations from Europe supply annually more than 100,000 individuals to the United States. This estimate is twenty times higher than the truth; for, in 1784 and 1792, when the United States received the greatest number of European colonists, their number did not exceed 5,000.† The progress of population in Mexico and North America is solely derived from an increase of internal prosperity.

CHAPTER VI.

Diversity of casts. Indians or indigenous Americans. Their number and their migrations. Diversity of languages. Degree of civilization of the Indians.

THE Mexican population is composed of the same elements as the other Spanish colonies. They reckon seven races: 1. The individuals born in Europe, vulgarly called *Gachupines;* 2. The Spanish Creoles, or whites of European extraction born in America; 3. The *Mestizos*, descendants of whites and Indians; 4. The Mulattoes, descendants of whites and negroes;

* Vol. II. p. 427.

† Samuel Blodget's Economica, 1806, p. 58.

5. The *Zambos*, descendants of negroes and Indians; 6. The Indians, or copper-coloured indigenous race; and, 7. The African negroes. Abstracting the subdivisions there are four casts: the whites, comprehended under the general name of Spaniards, the negroes, the Indians, and the men of mixed extraction, from Europeans, Africans, American Indians, and Malays; for from the frequent communication between Acapulco and the Philippine islands, many individuals of Asiatic origin, both Chinese and Malays, have settled in New Spain.

A very general prejudice exists in Europe that an exceeding small number of the copper-coloured race, or descendants of the ancient Mexicans, remain at this day. The cruelty of the Europeans has entirely extirpated the old inhabitants of the West Indies. The continent of America, however, has witnessed no such horrible result. The number of Indians in New Spain exceeds two millions and a half, including only those who have no mixture of European or African blood. What is still more consolatory, and we repeat it, is, that the indigenous population, far from declining, has been considerably on the increase for the last fifty years, as is proved by the registers of capitation or tribute.

In general the Indians appear to form two-fifths of the whole population of Mexico. In the four intendancies of Guanaxuato, Valladolid, Oaxaca, and la Puebla, this population amounts even to three-fifths. The enumeration of 1793 gave the following result.

Names of intendancies.	*Total population.*	*Number of Indians.*
Guanaxuato	398,000	175,000
Valladolid	290,000	119,000
Puebla	638,000	416,000
Oaxaca	411,000	363,000

From this table it appears that in the intendancy of Oaxaca, of 100 individuals 88 were Indians. So great a number of indigenous inhabitants undoubtedly proves the antiquity of the cultivation of this country. Accordingly, we find near Oaxaca remaining monuments of Mexican architecture, which prove a singularly advanced state of civilization.

The Indians, or copper-coloured race, are rarely to be found in the north of New Spain, and are hardly to be met with in the *provincias internas*. History gives us several causes for this phenomenon. When the Spaniards made the conquest of Mexico, they found very few inhabitants in the countries situated beyond the parallel of 20°. These provinces were the abode of the Chichimecks and Otomites, two pastoral nations, of whom thin hordes were scattered over a vast territory. Agriculture and civilization, as we have already observed, were concentrated in the plains south of the river of Santiago, especially between the valley of Mexico and the province of Oaxaca.

From the 7th to the 13th century, population seems in general to have continually flowed towards the south. From the regions situated to the north of the Rio Gila issued forth those warlike nations who successively inundated the country of Anahuac. We are ignorant whether that was their primitive country, or whether they came originally from Asia or the north-west coast of America, and traversed the savannas of Nabajoa and Moqui, to arrive at the Rio Gila. The hieroglyphical tables of the Aztecs have transmitted to us the memory of the principal epochs of the great migrations among the Americans. This migration bears some analogy to that which, in the fifth century, plunged Europe in a state of barbarism, of which we yet feel the fatal effects in many of our social institutions. However, the people who traversed Mexico left behind them traces of cultivation and ci-

vilization. The Toultecs appeared, first, in the year 648, the Chichimecks in 1170, the Nahualtecs in 1178, the Acolhues and Aztecs in 1196. The Toultecs introduced the cultivation of maize and cotton; they built cities, made roads, and constructed those great pyramids which are yet admired, and of which the faces are very accurately laid out. They knew the use of hieroglyphical paintings; they could found metals, and cut the hardest stones; and they had a solar year more perfect than that of the Greeks and Romans. The form of their government indicated that they were the descendants of a people who had experienced great vicissitudes in their social state. But where is the source of that cultivation? where is the country from which the Toultecs and Mexicans issued?

Tradition and historical hieroglyphics name Huehuetlapallan, Tollan, and Aztlan, as the first residence of these wandering nations. There are no remains at this day of any ancient civilization of the human species to the north of the Rio Gila, or in the northern regions travelled through by Hearne, Fiedler, and Mackenzie. But on the north-west coast, between Nootka and Cook river, especially under the 57° of north latitude, in Norfolk Bay and Cox Canal, the natives display a decided taste for hieroglyphical paintings.* M. Fleurieu, a man of distinguished learning, supposes that these people might be the descendants of some Mexican colony, which, at the period of the conquest, took refuge in those northern regions. This ingenious opinion will appear less probable if we consider the great distance which these colonists would have to travel, and reflect that the

* *Voyage de Marchand, tom.* I. p. 258. 261. 375. *Dixon*, p. 332. A harp represented in the hieroglyphical paintings of the inhabitants of the north-west coast of America, is an object at least as remarkable as the famous harp on the tombs of the kings of Thebes.

Mexican cultivation did not extend beyond the 20° of latitude. I am rather inclined to believe, that, on the migration of the Toultecs and Aztecs to the south, some tribes remained on the coasts of New Norfolk and New Cornwall, while the rest continued their course southwards. We can conceive how people, travelling *en masse*, for example, the Ostrogoths and Alani, were able to pass from the Black Sea into Spain; but how could we believe that a portion of these people were able to return from west to east, at an epoqua when other hordes had already occupied their first abodes on the banks of the Don or the Boristhenes?

This is not the place to discuss the great problem of the Asiatic origin of the Toultecs or Aztecs. The general question of the first origin of the inhabitants of the continent is beyond the limits prescribed to history; and is not, perhaps, even a philosophical question. There undoubtedly existed other people in Mexico at the time when the Toultecs arrived there in the course of their migration, and therefore to assert that the Toultecs are an Asiatic race is not maintaining that all the Americans came originally from Thibet or oriental Siberia. De Guignes attempted to prove by the Chinese annals that they visited America posterior to 458; and Horn, in his ingenious work *de Originibus Americanis*, published in 1699, M. Scherer, in his historical researches respecting the new world, and more recent writers, have made it appear extremely probable that old relations existed between Asia and America.

I have elsewhere advanced* that the Toultecs, or Aztecs, might be a part of those Hiongnoux, who, according to the Chinese historians, emigrated under their leader Punon, and were lost in the north parts of

* Tableaux de la Nature, vol. I. p. 53.

Siberia. This nation of warrior-shepherds has more than once changed the face of oriental Asia, and desolated, under the name of Huns, the finest parts of civilized Europe. All these conjectures will acquire more probability when a marked analogy shall be discovered between the languages of Tartary and those of the new continent; an analogy, which, according to the latest researches of M. Barton Smith, extends only to a very small number of words. The want of wheat, oats, barley, rye, and all those nutritive gramina which go under the general name of cereal, seems to prove, that if Asiatic tribes passed into America, they must have descended from pastoral people. We see in the old continent that the cultivation of cereal gramina, and the use of milk, were introduced as far back as we have any historical records. The inhabitants of the new continent cultivated no other gramina than maize, (*Zea.*) They fed on no species of milk, though the lamas, alpacas, and in the north of Mexico and Canada two kinds of indigenous oxen, would have afforded them milk in abundance. These are striking contrasts between the Mongol and American race.

Without losing ourselves in suppositions as to the first country of the Toultecs and the Aztecs, and without attempting to fix the geographical position of those ancient kingdoms of Huehuetlapallan and Aztlan, we shall confine ourselves to the accounts of the Spanish historians. The northern provinces, New Biscay, Sonora, and New Mexico, were very thinly inhabited in the 16th century. The natives were hunters and shepherds; and they withdrew as the European conquerors advanced towards the north. Agriculture alone attaches man to the soil, and developes the love of country. Thus we see that in the southern parts of Anahuac, in the cultivated region adjacent to Tenochtitlan, the Aztec colonists

tly endured the cruel vexations exercised to- them by their conquerors, and suffered every rather than quit the soil which their fathers had ated. But in the northern provinces, the natives d to the conquerors their uncultivated savannas, served for pasturage to the buffaloes. The s took refuge beyond the Rio Gila, towards o Zaguanas and the mountains de las Grullas. ndian tribes who formerly occupied the terri- f the United States and Canada followed the olicy; and chose rather to withdraw, first, be- he Alleghany mountains, then behind the Ohio, tly behind the Missouri, to avoid being forced among the Europeans. From the same cause d the copper-coloured race neither in the *pro- internas* of New Spain, nor in the cultivated f the United States.

migrations of the American tribes having been tly carried on from north to south, at least n the sixth and twelfth centuries, it is certain e Indian population of New Spain must be sed of very heterogeneous elements. In pro- as the population flowed towards the south, ribes would stop in their progress, and mingle e tribes which followed them. The great va- f languages still spoken in the kingdom of o proves a great variety of races and origin. number of these languages exceeds twenty, of fourteen have grammars and dictionaries tole- omplete. The following are their names: the an or Aztec language; the Otomite; the Ta- the Zapotec; the Mistec; the Maye or Yuca- e Totonac; the Popoluc; the Matlazing; astec; the Mixed; the Caquiquel; the Ta- ; the Tepehuan; and the Cora. It appears e most part of these languages, far from being s of the same, (as some authors have falsely ad- ,) are at least as different from one another as

the Greek and the German, or the French and Polish. This is the case at least with the seven languages of New Spain, of which I possess the vocabularies. The variety of idioms spoken by the people of the new continent, and which, without the least exaggeration, may be stated at some hundreds, offers a very striking phenomenon, particularly when we compare it with the few languages spoken in Asia and Europe.

The Mexican language, that of the Aztecs, is the most widely diffused, and extends at present from the 37° to the lake of Nicaragua, for a length of 400 leagues. The Abbé Clavigero* has proved that the Toultecs, the Chichimecks, (from whom the inhabitants of Tlascala are descended,) the Acolhues, and the Nahuatlacs, all spoke the same language as the Mexicans. This language is not so sonorous,† but almost as diffused and as rich as that of the Incas. After the Mexican or Aztec language, of which there exists eleven printed grammars, the most general language of New Spain is that of the Otomites.

I could not fail to interest the reader by a minute description of the manners, character, and physical and intellectual state of those indigenous inhabitants of Mexico, which the Spanish laws designate by the name of Indians. The general interest displayed in Europe for the remains of the primitive population of the new continent has its origin in a moral cause, which does honour to humanity. The history of the conquest of America and Hindostan presents the picture of an unequal struggle between nations far advanced in arts, and others in the very lowest degree of civilization. The unfortunate race of Aztecs escaped from the carnage appeared destined to anni-

* Clavigero, t. I. p. 153.

† The word *Notlazomahuiztepixcatatzin* signifies venerable priest whom I cherish as my father. The Mexicans use this word of 27 letters when speaking to the priests, (*curés.*)

hilation under an oppression of several centuries. We have difficulty in believing that nearly two millions and a half of aborigines could survive such lengthened calamities. The inhabitant of Mexico and Peru, and the Indian of the Ganges, attract in a very different manner from the Chinese or Japanese the attention of an observer endowed with sensibility. Such is the interest which the misfortune of a vanquished people inspires, that it renders us frequently unjust towards the descendants of the conquerors.

To give an accurate idea of the indigenous inhabitants of New Spain, it is not enough to paint them in their actual state of degradation and misery; we must go back to a remote period, when governed by its own laws, the nation could display its proper energy; and we must consult the hieroglyphical paintings, buildings of hewn stone, and works of sculpture still in preservation, which, though they attest the infancy of the arts, bear, however, a striking analogy to several monuments of the most civilized people. These researches are reserved for the historical account of our expedition to the tropics. The nature of this work does not permit us to enter into such details, however interesting they may be, both for the history, and the psychological study of our species. We shall merely point out here a few of the most prominent features of the immense picture of American indigenous population.

The Indians of New Spain bear a general resemblance to those who inhabit Canada, Florida, Peru, and Brasil. They have the same swarthy and copper colour, flat and smooth hair, small beard, squat body, long eye, with the corner directed upwards towards the temples, prominent cheek bones, thick lips, and an expression of gentleness in the mouth, strongly contrasted with a gloomy and severe look. The American race, after the hyperborean race, is the least numerous; but it occupies the greatest space

on the globe. Over a million and a half of square leagues, from the Terra del Fuego islands to the river St. Laurence and Baring's Straits, we are struck at the first glance with the general resemblance in the features of the inhabitants. We think we perceive that they all descend from the same stock, notwithstanding the enormous diversity of language which separates them from one another. However, when we reflect more seriously on this family likeness, after living longer among the indigenous Americans, we discover that celebrated travellers, who could only observe a few individuals on the coasts, have singularly exaggerated the analogy of form among the Americans.

Intellectual cultivation is what contributes the most to diversify the features. In barbarous nations there is rather a physiognomy peculiar to the tribe or horde than to any individual. When we compare our domestic animals with those which inhabit our forests we make the same observation. But a European, when he decides on the great resemblance among the copper-coloured races, is subject to a particular illusion. He is struck with a complexion so different from our own, and the uniformity of this complexion conceals for a long time from him the diversity of individual features. The new colonist can hardly at first distinguish the indigenous, because his eyes are less fixed on the gentle melancholic or ferocious expression of the countenance than on the red coppery colour and dark luminous and coarse and glossy hair, so glossy indeed that we should believe it to be in a constant state of humectation.

In the faithful portrait which an excellent observer, M. Volney, has drawn of the Canada Indians, we undoubtedly recognise the tribes scattered in the meadows of the Rio Apure and the Carony. The same style of feature exists no doubt in both Americas; but those Europeans who have sailed on the

great rivers Orinoco and Amazons, and have had occasion to see a great number of tribes assembled under the monastical hierarchy in the missions, must have observed that the American race contains nations whose features differ as essentially from one another, as the numerous varieties of the race of Caucasus, the Circassians, Moors, and Persians differ from one another. The tall form of the Patagonians, who inhabit the southern extremity of the new continent, is again found by us, as it were, among the Caribs who dwell in the plains from the Delta of the Orinoco to the sources of the Rio Blanco. What a difference between the figure, physiognomy, and physical constitution of these Caribs,* who ought to be accounted one of the most robust nations on the face of the earth, and are not to be confounded with the degenerate *Zambos*, formerly called Caribs in the island St. Vincent, and the squat bodies of the Chayma Indians of the province of Cumana! What a difference of form between the Indians of Tlascala and the Lipans and Chichimecks of the northern part of Mexico!

The Indians of New Spain have a more swarthy complexion than the inhabitants of the warmest climates of South America. This fact is so much the more remarkable, as in the race of Caucasus, which may be also called the European Arab race, the people of the south have not so fair a skin as those of the north. Though many of the Asiatic nations who inundated Europe in the sixth century had a very dark complexion, it appears, however, that the shades of colour observable among the white

* The great nation of the Caribs, or Caraibs, who, after having exterminated the Cabres, conquered a considerable part of South America, extended in the 16th century from the equator to the Virgin Islands. The few families who existed in our times in the Caribbee Islands, recently transported by the English, were a mixture of true Caribs and negroes.

race are less owing to their origin or mixture than to the local influence of the climate. This influence appears to have almost no effect on the Americans and negroes. These races, in which there is an abundant deposition of carburetted hydrogen in the *corpus mucosum* or *reticulatum* of Malpighi, resist in a singular manner the impressions of the ambient air. The negroes of the mountains of Upper Guinea are not less black than those who live on the coast. There are, no doubt, tribes of colour by no means deep among the Indians of the new continent, whose complexion approaches to that of the Arabs or Moors. We found the people of the Rio Negro swarthier than those of the Lower Orinoco, and yet the banks of the first of these rivers enjoy a much cooler climate than the more northern regions. In the forests of Guiana, especially near the sources of the Orinoco, are several tribes of a whitish complexion, the Guaicas, Guajaribs, and Arigues, of whom several robust individuals, exhibiting no symptom of the asthenical malady which characterises *albinos*, have the appearance of true Mestizoes. Yet these tribes have never mingled with Europeans, and are surrounded with other tribes of dark brown hue. The Indians in the torrid zone who inhabit the most elevated plains of the Cordillera of the Andes, and those who under the 45° of south latitude live by fishing among the islands of the archipelago of Chonos, have as coppery a complexion as those who under a burning climate cultivate bananas in the narrowest and deepest valleys of the equinoxial region. We must add, that the Indians of the mountains are clothed, and were so long before the conquest, while the aborigines who wander over the plains go quite naked, and are consequently always exposed to the perpendicular rays of the sun. I could never observe that in the same individual those parts of the body which were covered were less dark than those in contact with a warm

and humid air. We everywhere perceive that the colour of the American depends very little on the local position in which we see him. The Mexicans, as we have already observed, are more swarthy than the Indians of Quito and New Granada, who inhabit a climate completely analogous; and we even see that the tribes dispersed to the north of the Rio Gila are less brown than those in the neighbourhood of the kingdom of Guatimala. This deep colour continues to the coast nearest to Asia. But under the 54° 10′ of north latitude, at Cloak-bay, in the midst of copper-coloured Indians with small long eyes, there is a tribe with large eyes, European features, and a skin less dark than that of our peasantry. All these facts tend to prove that notwithstanding the variety of climates and elevations inhabited by the different races of men, nature never deviates from the model of which she made selection thousands of years ago.

My observations on the innate colour of the aborigenes differ in part from the assertions of Michikinakoua, the celebrated chief of the Miamis, called by the Anglo-Americans *Little Crook-back*, (Petite Tortue,) who communicated so much valuable information to M. Volney. He asserted "that the children of the Canada Indians were born as white as Europeans; that the adults are darkened by the sun, and the grease and the juices of herbs with which they rub their skin; and that that part of the waist of the females which is perpetually covered is always white."* I have never seen the Canada nations of which the chief of the Miamis speaks; but I can affirm that in Peru, Quito, on the coast of Caraccas, the banks of the Orinoco, and in Mexico, the children are never born white, and that the Indian Caciques, who enjoy a certain degree of ease in their cir-

* *Volney, Tableau du Climat et du Sol des Etats-Unis*, vol. ii. p. 435.

cumstances, and who remain clothed in the interior of their houses, have all the parts of their body (with the exception of the hollow of their hand and the sole of their foot) of the same brownish-red or coppery colour.*

The Mexicans, particularly those of the Aztec and Otomite race, have more beard than I ever saw in any other Indians of South America. Almost all the Indians in the neighbourhood of the capital wear small mustaches; and this is even a mark of the tributary cast. These mustaches, which modern travellers have also found among the inhabitants of the north-west coast of America, are so much the more curious, as celebrated naturalists have left the question undetermined, whether the Americans have naturally no beard and no hair on the rest of their bodies, or whether they pluck them carefully out. Without entering here into physiological details, I can affirm that the Indians who inhabit the torrid zone of South America have generally some beard; and that this beard increases when they shave themselves, of which we have seen examples in the missions of the capuchins of Caripe, where the Indian sextons wish to resemble the monks their masters. But many individuals are born entirely without beard or

* This account of Little Crook-back is partly confirmed by Father Gumilla, who says that the Indians remain white for several days after they are born, with the exception of a small spot, *acia la parte posterior de la cintura*, of an obscure colour. I have seen and examined that spot, says he, repeatedly. "Al nacer aquellos ninos son blancos por algunos dias. Nacen los Indiecillos con una mancha acia la parte posterior de la cintura, de color obscuro, con viso de entre morado y pardo, la qual se va desvaneciendo, al passo que la criatura va perdiendo el color blanco, y adquiriendo el suyo natural. Esta sena ò mancha es cierta, y cosa que tengo vista, y examinada repetidas veces: su tamano es poco mas, ò menos del espacio que occupa un peso duro de nueva fabrica. *Gumilla, Orinoco illustrado.* Vol. i. p. 82. *Trans.*

hair on their bodies. M. de Galeano, in the account of the last Spanish expedition to the Straits of Magellan,* informs us, that there are many old men among the Patagonians with beards, though they are short and by no means bushy. On comparing this assertion with the facts collected by Marchand, Mears, and especially M. Volney, in the northern temperate zone, we are tempted to believe that the Indians have more and more beard in proportion to their distance from the equator. However, this apparent want of beard is by no means peculiar to the American race, for many hordes of Eastern Asia, and especially several tribes of African negroes, have so little beard that we should be almost tempted to deny entirely its existence. The negroes of Congo and the Caribs, two eminently robust races, and frequently of a colossal stature, prove that to look upon a beardless chin as a sure sign of the degeneration and physical weakness of the human species is a mere physiological dream. We forget that all which has been observed in the Caucasian race does not equally apply to the Mongol or American race, or to the African negroes.

The Indians of New Spain, those at least subject to the European domination, generally attain a pretty advanced age. Peaceable cultivators, and collected these six hundred years in villages, they are not exposed to the accidents of the wandering life of the hunters and warriors of the Mississippi and the savannas of the Rio Gila. Accustomed to uniform nourishment of an almost entirely vegetable nature, that of their maize and cereal gramina, the Indians would undoubtedly attain a very great longevity if their constitutions were not weakened by drunkenness. Their intoxicating liquors are rum, a fermentation of maize and the root of the jatropha, and

* *Viaje al Estrecho de Magellanes*, p. 331.

especially the wine of the country, made of the juice of the agave americana, called *pulque*. This last liquor, of which we shall have occasion to speak in the following book, is even nutritive, on account of the undecomposed sugar which it contains. Many Indians addicted to *pulque* take for a long time very little solid nourishment. When taken with moderation it is very salutary, and by fortifying the stomach, assists the functions of the gastric system.

The vice of drunkenness is, however, less general among the Indians than is generally believed. Those Europeans who have travelled to the east of the Alleghany mountains, between the Ohio and the Missouri, will with difficulty believe that, in the forests of Guiana and on the banks of the Orinoco, we saw Indians who showed an aversion for the brandy which we made them taste. There are several Indian tribes, very sober, whose fermented beverages are too weak to intoxicate. In New Spain drunkenness is most common among the Indians who inhabit the valley of Mexico, and the environs of Puebla and Tlascala, wherever the maguey or agave are cultivated on a great scale. The police in the city of Mexico sends round tumbrels, to collect the drunkards to be found stretched out in the streets. These Indians, who are treated like dead bodies, are carried to the principal guard-house. In the morning an iron ring is put round their ancles, and they are made to clear the streets for three days. On letting them go on the fourth day, they are sure to find several of them in the course of the week. The excess of liquors is also very injurious to the health of the lower people in the warm countries on the coast which grow sugar cane. It is to be hoped that this evil will diminish as civilization makes more progress among a cast of men whose bestiality is not much different from that of the brutes.

Travellers who merely judge from the physiognomy of the Indians are tempted to believe that it is rare to see old men among them. In fact, without consulting parish registers, which in warm regions are devoured by the termites every twenty or thirty years, it is very difficult to form any idea of the age of Indians: they themselves (I allude to the poor labouring Indian) are completely ignorant of it. Their head never becomes gray. It is infinitely more rare to find an Indian than a negro with gray hairs, and the want of beard gives the former a continual air of youth.* The skin of the Indians is also less subject to wrinkles. It is by no means uncommon to see in Mexico, in the temperate zone half way up the Cordillera, natives, and especially women, reach a hundred years of age. This old age is generally comfortable; for the Mexican and Peruvian Indians preserve their muscular strength to the last. While I was at Lima the Indian Hilario Pari died at the village of Chiguata, four leagues distant from the town of Arequipa, at the age of 143. He remained united in marriage for 90 years to an Indian of the name of Andrea Alea Zar, who attained the

* This account differs from that of Ulloa, who says expressly that the symptoms of old age among the Indians are *gray hairs* and a *beard: pero hay dos senales que manifiestan quando son de edad muy abanzada: la una las canas, y la otra las barbas.* The whole passage runs thus, "Son por lo general de larga vida, aunque dificil de averiguar el numero de sus anos; pero hay dos senales que manifiestan quando son de edad muy abanzada; la una las canas, y la otra las barbas: aquellas no empiezcan à parecer hasta que estan en 70 anos ò cerca de ellas: estas otras hasta que passan de 60, y siempre son pocas; y asi quando se ven *del todo encanecidos*, y que las pocas barbas le estan igualmente, se jusga que pasan de un siglo." (Noticias Americanas, p. 323.) The accuracy of Ulloa, and the opportunities which he had of observing every variety of Indian race, are very universally known. Father Gumilla gives an account somewhat similar to Ulloa's. *Trans.*

age of 117. This old Peruvian went, at the age of 130, from three to four leagues daily on foot. He became blind 13 years before his death and left behind him of 12 children but one daughter, of 77 years of age.

The copper-coloured Indians enjoy one great physical advantage, which is undoubtedly owing to the great simplicity in which their ancestors lived for thousands of years. They are subject to almost no deformity. I never saw a hunchbacked Indian; and it is extremely rare to see any of them who squint, or are lame in the arm or leg. In the countries where the inhabitants suffer from the *goitre*, this affection of the thyroid gland is never observed among the Indians, and seldom among the Mestizoes. Martin Salmeron, the famous Mexican giant, belongs to the last class, though erroneously said to be an Indian, whose height is 2,224 metres or six feet ten inches, and 2 2-3 lines of Paris.* He is the son of a Mestizo, who married an Indian woman of the village of Chilapa el Grande, near Chilpansingo.†

When we examine savage hunters or warriors we are tempted to believe that they are all well made, because those who have any natural deformity either perish from fatigue or are exposed by their parents; but the Mexican and Peruvian Indians, those of Quito and New Granada, are agriculturists, who can only be compared with the class of European peasantry. We can have no doubt then that the absence

* 87.521 inches, or 7 feet 3 1-2 inches. *Trans.*

† Such is the real size of this giant, the best proportioned whom I have ever seen. He is an inch taller than the giant of Torneo, seen at Paris in 1735. The American Gazettes make Salmeron 7 feet 1 inch of Paris measure. *Gazetta de Goatimala*, 1800. *Agosto*, Annales de Madrid, t. IV. No. 12. The human species appears to vary from 2 feet 4 inches to 7 feet 8 inches, or from 0^m, 757 to 2^m, 489. (*Schreber Mamm.* t. I. p. 27.)

of natural deformities among them is the effect of their mode of life, and of the constitution peculiar to their race. All the men of very swarthy complexion, those of Mongol and American origin, and especially the negroes, participate in the same advantage. We are inclined to believe that the Arab-European race possesses a greater flexibility of organization, and that it is easier modified by a great number of exterior causes, such as variety of aliments, climates, and habits, and consequently has a greater tendency to deviate from its original model.

What we have been stating as to the exterior form of the indigenous Americans confirms the accounts of other travellers of the striking analogy between the Americans and the Mongol race. This analogy is particularly evident in the colour of the skin and hair, in the defective beard, high cheek bones, and in the direction of the eyes. We cannot refuse to admit that the human species does not contain races resembling one another more than the Americans, Mongols, Mantcheoux, and Malays. But the resemblance of some features does not constitute an *identity* of race. If the hieroglyphical paintings and traditions of the inhabitants of Anahuac, collected by the first conquerors, appear to indicate that a swarm of wandering tribes spread from the north-west towards the south, we must not therefore conclude that all the Indians of the new continent are of Asiatic origin. In fact, osteology teaches us that the cranium of the American differs essentially from that of the Mongol: the former exhibits a facial line, more inclined, though straighter, than that of the negro: and there is no race on the globe in which the frontal bone is more depressed backwards, or which has a less projecting forehead.* The cheek-bones of the

* This extraordinary flatness is to be found among nations to whom the means of producing artificial deformity are to-

American are almost as prominent as those of the Mongol; but the contours are more rounded, and the angles not so sharp. The under jaw is larger than the negroes, and its branches are less dispersed than the Mongols. The *occipital bone* is less curved, (*bombé*,) and the protuberances which correspond to the *cerebellum*, to which the system of M. Gall attaches great importance, are scarcely sensible. Perhaps this race of copper-coloured men, comprehended under the general name of American Indians, is a mixture of Asiatic tribes and the aborigines of this vast continent; and it is not unlikely also that the figures with enormous aquiline noses, observed in the hieroglyphical Mexican paintings preserved at Vienna, Veletri, and Rome, as in my historical fragments, indicated the physiognomy of some races now extinct. The Canadian savages call themselves Metoktheniakes, born of the sun, without allowing themselves to be persuaded of the contrary by the *black robes*,* a name which they give to the missionaries.

As to the moral faculties of the Indians, it is difficult to appreciate them with justice, if we only con-

tally unknown, as is proved by the *crania* of Mexican Indians, Peruvians, and Atures, brought over by M. Bonpland and myself, of which several were deposited in the Museum of Natural History at Paris. I am inclined to believe that the barbarous custom which prevails among several hordes of pressing the heads of children between two boards had its origin in the idea that beauty consists in such a form of the frontal bone as to characterise the race in a decided manner. The negroes give the preference to the thickest and most prominent lips; the Calmucks to turned-up noses; and the Greeks in the statues of heroes have raised the facial line from 85° to 100° beyond nature. (Cuvier, *Anat. Comparée*, t. II. p. 6.) The Aztecs, who never disfigure the heads of their children, represent their principal divinities, as their hieroglyphical manuscripts prove, with a head much more flattened than any I have ever seen among the Caribs.

* Volney, t. II. p. 438.

sider this long oppressed cast in their present state of degradation. The better sort of Indians, among whom a certain degree of intellectual culture might be supposed, perished in great part at the commencement of the Spanish conquest, the victims of European ferocity. The Christian fanaticism broke out in a particular manner against the Aztec priests; and the Teopixqui, or ministers of the divinity, and all those who inhabited the Teocalli,* or houses of God, who might be considered as the depositories of the historical, mythological, and astronomical knowledge of the country, were exterminated; for the priests observed the meridian shade in the gnomons, and regulated the calendar. The monks burned the hieroglyphical paintings, by which every kind of knowledge was transmitted from generation to generation. The people, deprived of these means of instruction, were plunged in an ignorance so much the deeper as the missionaries were unskilled in the Mexican languages, and could substitute few new ideas in the place of the old. The Indian women who had preserved any share of fortune chose rather to ally with the conquerors than to share the contempt in which the Indians were held. The Spanish soldiers were so much the more eager for these alliances, as very few European women had followed the army. The remaining natives then consisted only of the most indigent race, poor cultivators, artisans, among whom were a great number of weavers, porters, who were used like beasts of burden, and especially of those dregs of the people, those crowds of beggars, who bore witness to the imperfection of the social institutions, and the existence of feudal oppression, and who filled, in the time of Cortez, the streets of all the great cities of the Mexican empire. How shall we judge, then, from these mi-

* From Teotl, God.

serable remains of a powerful people, of the degree of cultivation to which it had risen from the twelfth to the sixteenth century, and of the intellectual development of which it is susceptible? If all that remained of the French or German nation were a few poor agriculturists, could we read in their features that they belonged to nations which had produced a Descartes and Clairaut, a Kepler and a Leibnitz?

We observe that even in Europe the lower people, for whole centuries, make very slow progress in civilization. The peasant of Brittany or Normandy, and the inhabitant of the north of Scotland, differ very little at this day from what they were in the time of Henry the Fourth and James the First.* When we consider attentively what is related in the letters of Cortez, the memoirs of Bernal Diaz, written with admirable naiveté, and other cotemporary historians, as to the state of the inhabitants of Mexico, Tezcuco, Cholollan, and Tlascala, in the time of Montezuma the Second, we think we perceive the portrait of the Indians of our own time. We see the same nudity in the warm regions, the same form of dress in the central table-land, and the same habits in domestic life. How can any great change take place in the Indians when they are kept insulated in villages in which the whites dare not settle, when the difference of language places an almost insurmountable barrier between them and the Europeans, when they are oppressed by magistrates

* What is here asserted of the highlands of Scotland might have had more foundation fifty years ago. A barren and mountainous country must ever oppose great obstacles to improvement and civilization; but it is believed that these obstacles have seldom been more successfully overcome than in the highlands. Of this abundant proof might be found in the statistical account of Scotland, did not the high moral character observable in the highland regiments establish it beyond a doubt. *Trans.*

chosen through political considerations from their own number, and, in short, when they can only expect moral and civil improvement from a man who talks to them of mysteries, dogmas, and ceremonies, of the end of which they are ignorant.

I do not mean to discuss here what the Mexicans were before the Spanish conquest; this interesting subject has been already entered upon in the commencement of this chapter. When we consider that they had an almost exact knowledge of the duration of the year, that they intercalated at the end of their great cycle of 104 years with more accuracy than the Greeks,* Romans, and Egyptians, we are tempted to believe that this progress is not the effect of the intellectual development of the Americans themselves, but that they were indebted for it to their communication with some very cultivated nations of central Asia. The Toultecs appeared in New Spain in the 7th, and the Aztecs in the 12th century; and they immediately drew up the geographical map of the country traversed by them, constructed cities, highways, dikes, canals, and immense pyramids very accurately designed, of a base of 438 metres† in length. Their feudal system, their civil and military hierarchy, were already so complicated, that we must suppose a long succession of political events before the establishment of the singular concatenation of authorities of the nobility and clergy, and before a small portion of the people, themselves the slaves of the Mexican sultan, could have subjugated

* M. Laplace discovered in the Mexican intercalation, for which I furnished him materials collected by Gama, that the duration of the tropical year of the Mexicans is almost the identical duration found by the astronomers of Almamon. For this observation, of such importance in the history of the origin of the Aztecs, see *Exposition du Système du Monde, troisieme edition*, p. 554.

† 1,436 feet. *Trans.*

the great mass of the nation. We have examples of theocratical forms of government in South America; for such were those of the Zac* of Bogota, (the ancient Cundinamarca,) and of the Inca of Peru, two extensive empires, in which despotism was concealed under the appearance of a gentle and patriarchal government. But in Mexico, small colonies, wearied of tyranny, gave themselves republican constitutions. Now it is only after long popular struggles that these free constitutions can be formed. The existence of republics does not indicate a very recent civilization. How is it possible to doubt that a part of the Mexican nation had arrived at a certain degree of cultivation, when we reflect on the care with which their hieroglyphical books† were composed,

* The empire of the Zac, which comprehended the kingdom of New Granada, was founded by Idacanzas or Bochica, a mysterious personage, who, according to the traditions of the Mozcas, lived in the temple of the sun at Sogamozo during 2,000 years.

† The Aztec manuscripts are written either on agave paper, or on stag skins; they are frequently from 20 to 22 metres (65 to 71 English feet) in length; and each page contains from 7 to 10 centimetres, or from 100 to 150 square inches (French) of surface. These manuscripts are folded here and there in the form of a rhomb, and thin wooden boards fastened to the extremities form their binding, and give them a resemblance to our books in quarto. No nation of the old continent ever made such an extensive use of hieroglyphical writing; and in none of them do we see real books bound in the way I have been describing. We must not confound with these books other Aztec paintings, composed of the same signs, but in the form of tapestries of 63 decimetres, or 60 square feet, (French.) I have seen some of them in the archives of the viceroyalty of Mexico; and I myself possess fragments of them, which I have caused to be engraved in the picturesque atlas which accompanies the historical account of my travels. *Author.*

The numbers in the above note are totally irreconcilable with one another. A centimetre is equal to .36941 of a French inch, consequently 7 and 10 centimetres are only .9552 and 1.3645 French square inches, and nothing like

and when we recollect that a citizen of Tlascala, in the midst of the tumults of war, took advantage of the facility offered him by our Roman alphabet to write in his own language five large volumes on the history of a country of which he deplored the subjection?

We shall not here attempt to resolve the problem, however important it may be for history, whether the Mexicans of the 15th century were more civilized than the Peruvians, or whether, if both had been abandoned to themselves, they would have made more rapid advances towards intellectual cultivation than they have done under the domination of the Spanish clergy. Neither shall we examine whether, notwithstanding the despotism of the Aztec princes, the improvement of the individual found fewer obstacles in Mexico than in the empire of the Incas. In the latter the legislator wished only to influence the people *en masse*; and by subjecting them to a monastic obedience, and treating them like machines, he compelled them to undertake works, the regularity and magnitude of which astonish us as much as the perseverance of those who directed them. If we analyze the mechanism of this Peruvian theocracy, generally too much exalted in Europe, we shall find that wherever people are divided into casts, of which each can only follow a certain species of labour, and wherever the inhabitants possess no particular property, and labour merely for the benefit of the community, canals, roads, aqueducts, pyramids, and immense constructions will also be found; but that the people preserving for thousands of years the same appearance of external comfort make almost no ad-

100 and 150 square inches. In the same way a decimetre being only as 3.24835 : 12 of a French foot, 63 decimetres make 5.97 and not 60 square feet French. Some mistake must therefore be either in the metrical or common measures here assigned, or in both. *Trans.*

vances in moral cultivation, which is the result of individual liberty alone.

In the portrait which we draw of the different races of men composing the population of New Spain, we shall merely consider the Mexican Indian in his actual state. We perceive in him neither that mobility of sensation, gesture, or feature, nor that activity of mind for which several nations of the equinoxial regions of Africa are so advantageously distinguished. There cannot exist a more marked contrast than that between the impetuous vivacity of the Congo negro, and the apparent phlegm of the Indian. From a feeling of this contrast, the Indian women not only prefer the negroes to the men of their own race, but also to the Europeans. The Mexican Indian is grave, melancholic, and silent,* so long as he is not under the influence of intoxicating liquors. This gravity is particularly remarkable in Indian children, who, at the age of four or five, display much more intelligence and maturity than white children. The Mexican loves to throw a mysterious air over the most indifferent actions. The most violent passions are never painted in his features; and there is something frightful in seeing him pass all at once from absolute repose to a state

* It is difficult to reconcile altogether this account of the Indian taciturnity with that given by Ulloa in his *Noticias Americanas*. He first describes the savage Indians as "largos en los discursos, repitiendo muchas vezes la misma cosa, y durarian el dia entero sin anadir nada à lo que dixeron al principio, si no les procurasse cortar." "En este modo de perorar con presuncion," he continues, "fundan tambien su ciencia, y la habilidad con que sobresalen a las otras personas Europeas con quienes tratan, persuadendose à que los inducen a franquearles lo que desean con su grande eloquencia." This may be thought only to apply to the savage Indians; but he adds, "*Los Indios reducidos* son lo mismo en sus discursos, largos, cansados, è importunos hasta el extremo; y si el lenguage no fuese distinto, podria creerse que un Indio del *Peru* hablaba en el Norte o al contrario." (p. 334.) *Trans.*

of violent and unrestrained agitation. The Peruvian Indian possesses more gentleness of manners; the energy of the Mexican degenerates into harshness. These differences may have their origin in the different religions and different governments of the two countries in former times. This energy is displayed particularly by the inhabitants of Tlascala. In the midst of their present degradation, the descendants of those republicans are still to be distinguished by a certain haughtiness of character, inspired by the memory of their former grandeur.

The Americans, like the Hindoos and other nations who have long groaned under a civil and military despotism, adhere to their customs, manners, and opinions, with extraordinary obstinacy. I say opinions, for the introduction of christianity has produced almost no other effect on the Indians of Mexico than to substitute new ceremonies, the symbols of a gentle and humane religion, to the ceremonies of a sanguinary worship. This change from old to new rites was the effect of constraint and not of persuasion, and was produced by political events alone. In the new continent, as well as in the old, half civilized nations were accustomed to receive from the hands of the conqueror new laws and new divinities; and the vanquished Indian gods appeared to them to yield to the gods of the strangers.* In such a com-

* The Indians appear to have been not at all contented with their gods, and to have wished only to get well rid of them at the arrival of the Spaniards. Such at least were the sentiments of the principal Indians in New Spain, if we may believe Acosta. When an old Indian chief was asked by a reverend father why they had thrown up their own religion without either proof, or investigation, or dispute, and adopted that of Christ in its place? "We did not act so inconsiderately," he replied, "as you seem to imagine, for we were so wearied and discontented with our gods that we had deliberated about leaving them in good earnest, and adopting others" (porque le hago saber, que estavamos ya tan cansa-

plicated mythology as that of the Mexicans, it was easy to find out an affinity between the divinities of Aztlan and the divinity of the east. Cortez even very artfully took advantage of a popular tradition, according to which the Spaniards were merely the descendants of king Quitzalcoatl, who left Mexico for countries situated in the east, to carry among them civilization and laws. The ritual books composed by the Indians in hieroglyphics at the beginning of the conquest, of which I possess several fragments, evidently show that at that period christianity was confounded with the Mexican mythology: the Holy Ghost is identified with the sacred eagle of the Aztecs. The missionaries not only tolerated, they even favoured to a certain extent, this amalgamation of ideas, by means of which the christian worship was more easily introduced among the natives.*

dos y descontentos, con las co sas que los y dolos nos mandavan, que aviamos tratado de dexarlos y tomar otra ley.) Acosta, p. 357. *Trans.*

* The missionaries do not seem to have concerned themselves much about the motives from which the Indians became christians. Their great object was to get as many baptized as possible, after which all was safe; and they were very much concerned when a parting soul could not be snatched from hell for want of a drop of water in the place at the critical moment. (Ay! no una gota en el rancho, *Gumilla*, II. 21.) They were indefatigable in scenting out dying people, *para lograr sus almas*. An old woman (*anciana*) on the point of death, who, from seeing baptism and death generally follow so close upon one another, had very naturally associated them in her mind as inseparable, long resisted all the attempts of a holy father to baptize her. When asked her reason, she said it was for fear of death. "O!" replies the father, "I want to baptize you to secure you a life that will never end." (Para asegurarle una vida que no se accabe.) "If that be the case," cries the old woman, "baptize me immediately." (Yo tambien quiero que me bautices.) "I praised God," says Father Gumilla, "on seeing that nobody likes to die, however troublesome life may be, and I admired the stubbornness of that heart which could still flatter itself with such motives: but I immediately baptized her."

They persuaded them that the gospel had, in very remote times, been already preached in America; and they investigated its traces in the Aztec ritual with the same ardour which the learned, who in our days engage in the study of the Sanscrit, display in discussing the analogy between the Greek mythology and that of the Ganges and the Barampooter.

(*Luego la bauticé.*) Gumilla, vol. II. p. 25. Nothing can be more entertaining than the accounts given by the missionaries themselves of the arts and finesse to which they were compelled to have recourse to gain over those unfortunate sons of Adam, *para obrar la eterna dicha de aquellos infelices hijos de Adan.* Father Gumilla, in his instructions to young missionaries, lays them open with more naiveté than prudence, as we might think; but the father very piously considered that the end justified the means. It must be owned that the missionaries displayed great knowledge of human nature. Not a word of religion for a long time. Presents and kind offices, and long endeavours to obtain the Indian's confidence by anticipating his wants, and entering into his views; but above all, the acquisition of the influence which their females naturally possessed over them, were the prelude to the grand attack. "The females," one of them observes, "have every where a great capacity for piety, and must be first attended to." This battery was to be concealed, for if the drift was to be perceived in the least all was lost. (*Todo esta primera batería ha de ser oculta de parte del Missionero; porque si se aclara, pierde el viage.*) (Gumilla, vol. I. p. 355.) After giving a summary of the labours and innumerable shifts of these indefatigable soul-hunters, (*Cazadores de Almas,*) overpowered with the retrospect, the missionary feelingly exclaims, O! quien podra explicar las ganas, que tienen aquellos Cazadores de Almas, de que se compongan bien las cosas, y se legue la hora de poder bautizar aquellos inocentes sin peligro!

One of the greatest difficulties in which the holy fathers were placed, was how to reject the offer of a female companion, which was generally made them, without giving offence al Cacique y a los principales gentiles. When the father modestly blushed, (con la mayor modestia bien sonrosado el rostro,) and answered that all his love was in heaven, it is impossible to tell the fright and consternation it occasioned. (No sabré decir quanta novedad, y espanto causa esta o semejante respuesta.) Gumilla, vol. I. p. 356. *Trans.*

These circumstances, which will be detailed in another work, explain why the Mexican Indians, notwithstanding the obstinacy with which they adhere to whatever is derived from their fathers, have so easily forgotten their ancient rites. Dogma has not succeeded to dogma, but ceremony to ceremony. The natives know nothing of religion but the exterior forms of worship. Fond of whatever is connected with a prescribed order of ceremonies, they find in the christian religion particular enjoyments. The festivals of the church, the fireworks with which they are accompanied, the processions mingled with dances and whimsical disguises, are a most fertile source of amusement for the lower Indians. In these festivals the national character is displayed in all its individuality. Everywhere the christian rites have assumed the shades of the country where they have been transplanted. In the Philippine and Mariana islands, the natives of the Malay race have incorporated them with the ceremonies which are peculiar to themselves; and in the province of Pasto, on the ridge of the Cordillera of the Andes, I have seen Indians, masked and adorned with small tinkling bells, perform savage dances around the altar, while a monk of St. Francis elevated the host.*

* From this singular description we may discover more plainly the impolicy with which conversions have been hitherto attempted in foreign parts by our missionary societies. Had they sent away instead of the anabaptists, methodists, and presbyterians which they picked up in Sweden, the north of Germany, both parts of this island, and the Lord knows where, an equal number of our more volatile catholic brethren in Ireland, the conversion might already, perhaps, have made a great progress. The people of Otaheité very feelingly exclaimed, "These missionaries give us still plenty of the word of God, but they give us no more hatchets;" but they would have been probably just as well contented with singing, and dancing, and fireworks. This is a much more economical method of keeping these people assembled together than the distribution of hatchets. The catholics went

Accustomed to a long slavery, as well under the domination of their own sovereigns as under that of the first conquerors, the natives of Mexico patiently suffer the vexations to which they are frequently exposed from the whites. They oppose to them only a cunning, veiled under the most deceitful appearances of apathy and stupidity. As the Indian can very rarely revenge himself on the Spaniards, he delights in making a common cause with them for the oppression of his own fellow-citizens. Harassed for ages, and compelled to a blind obedience, he wishes to tyrannize in his turn. The Indian villages are governed by magistrates of the copper-coloured race; and an Indian alcalde exercises his power with so much the greater severity because he is sure of being supported by the priest, or the *Spanish subdelegado*. Oppression produces everywhere the same effects, it every where corrupts the morals.*

better to work. They, too, knew the power of this sort of hatchet bribery. "Se deba llevar avalorios, cuentas de vidrio, cuchillos, anzuelos, y otras buxerias, que para los Gentiles son de mucho aprecio." (Gumilla, I. 349.) But they knew that this source must soon dry up; and the holy fathers set all their natural gallantry to work to gain over the women, who seem to be equally susceptible in that quarter, whether savage or civilized, as the men they were aware would soon follow them. They said kind things to the women, praised the beauty of their children, took them up in their arms and caressed them. The women are very fond of that, says a father, Quando va a ver a los Indios en sus casas, tome en sus brazos alguno de aquellos parvulos, le accaricie y haga fiestas a su modo: esto apprecian grandement *las Indias*. How are we to be astonished then at the very different results of the endeavours of these two classes of missionaries! *Trans.*

* The present state of the world unfortunately affords too good an illustration of this maxim. The West-Indian slave when he becomes a master is the most cruel of all masters; and the life of a negro's cat, or dog, is synonymous there with a life not worth having. The Greeks, who are much employed in collecting the revenue in Turkey, are infinitely

As the Indians almost all of them belong to the class of peasantry and low people, it is not so easy to judge of their aptitude for the arts which embellish life. I know no race of men who appear more destitute of imagination. When an Indian attains a certain degree of civilization, he displays a great facility of apprehension, a judicious mind, a natural logic, and a particular disposition to subtilize or seize the finest differences in the comparison of objects. He reasons coolly and orderly, but he never manifests that versatility of imagination, that glow of sentiment, and that creative and animating art which characterize the nations of the south of Europe, and several tribes of African negroes.* I deliver this opinion, however, with great reserve. We ought to be infinitely circumspect in pronouncing on the moral or intellectual dispositions of nations from which we are separated by the multiplied obstacles which result from a difference in language, and a difference of manners and customs. A philosophical observer finds what has been printed in the centre of Europe on the national character of the French, Italians, and Germans, inaccurate. How, then, should a traveller, after merely landing in an island, or remaining only a short time in a distant country, arrogate to himself the right of deciding on the different faculties of

more persecuting than the Turks. And the Hindoo has his most grievous calamities to apprehend from his own brethren, armed with foreign authority. Everywhere cunning and cruelty spring from tyranny and oppression. *Trans.*

* What must our brethren of the northern part of this island, who have attained no small reputation for a pragmatical and metaphysical disposition, and who are so much disposed to give metaphysical superiority a precedence over all the other human faculties, feel, when they find that, most probably, their future rivals are not to spring up in any of the rival colleges of the south, or even in any of the great German universities, but among the beardless tribes of the Mexican mountains, and the banks of the Orinoco. *Trans.*

the soul, on the preponderance of reason, wit, or imagination among nations?

The music and dancing of the natives partake of this want of gayety which characterizes them. M. Bonpland and myself observed the same thing in all South America. Their songs are terrific and melancholic. The Indian women show more vivacity than the men; but they share the usual misfortunes of the servitude to which the sex is condemned among nations where civilization is in its infancy. The women take no share in the dancing; but they remain present to offer fermented draughts to the dancers, prepared by their own hands.

The Mexicans have preserved a particular relish for painting, and for the art of carving in wood or stone. We are astonished at what they are able to execute with a bad knife on the hardest wood. They are particularly fond of painting images, and carving statues of saints. They have been servilely imitating for these three hundred years, the models which the Europeans imported with them at the conquest. This imitation is derived from a religious principle of a very remote origin. In Mexico, as in Hindostan, it was not allowable in the faithful to change the figure of their idols in the smallest degree. Whatever made a part of the Aztec or Hindoo ritual was subjected to immutable laws. For this reason we shall form a very imperfect judgment of the state of the arts, and the natural taste of these nations, if we merely consider the monstrous figures under which they represent their divinities. The christian images have preserved in Mexico a part of that stiffness and that harshness of feature which characterize the hieroglyphical pictures of the age of Montezuma. Many Indian children educated in the college of the capital, or instructed at the academy of painting founded by the king, have no doubt distinguished themselves; but it is much less by their genius than their appli-

cation. Without ever leaving the beaten track, the display great aptitude in the exercise of the arts imitation; and they display a much greater still fo the purely mechanical arts. This aptitude canno fail of becoming some day very valuable, when th manufactures shall take their flight to a country where a regenerating government remains yet to be created.

The Mexican Indians have preserved the same taste for flowers which Cortez found in his time. A nosegay was the most valuable treat which could be made to the ambassadors who visited the court o Montezuma. This monarch and his predecessor had collected a great number of rare plants in the gardens of Istapalapan. The famous *hand-tree*, th cheirostemon,* described by M. Cervantes, of which for a long time only a single individual was know of very high antiquity, appears to indicate that th kings of Toluca cultivated also trees strangers to th part of Mexico. Cortez, in his letters to the Emp ror Charles the Fifth, frequently boasts of the indu try which the Mexicans displayed in gardening; a he complains that they did not send him the seeds ornamental flowers and useful plants which he de manded for his friends of Seville and Madrid. Th taste for flowers undoubtedly indicates a relish for th beautiful; and we are astonished at finding it in nation in which a sanguinary worship and the fr quency of sacrifices appeared to have extinguishe whatever related to the sensibility of the soul, an kindness of affection. In the great market-place

* M. Bonpland has given a drawing of it in our *Plant Equinoxiales*, vol. i. p. 75. pl. 24. For some little time pa roots of the *Arbol de las manitas* have been in the gard ns Montpellier and Paris. The cheirostemon is as rema kab for the form of its corolla as the Mexican gyrocarpus whi we have introduced into the European gardens, and of whi the celebrated Jacquin could not discover the flower, is f the form of its fruits.

Mexico the native sells no peaches, nor ananas, nor roots, nor pulque, (the fermented juice of the agave,) without having his shop ornamented with flowers, which are every day renewed. The Indian merchant appears seated in an intrenchment of verdure. A hedge of a metre* in height, formed of fresh herbs, particularly of gramina with delicate leaves, surrounds like a semicircular wall the fruits offered to public sale. The bottom of a smooth green, is divided by garlands of flowers which run parallel to one another. Small nosegays placed symmetrically between the festoons give this enclosure the appearance of a carpet strewn with flowers. The European who delights in studying the customs of the lower people, cannot help being struck with the care and elegance the natives display in distributing the fruits which they sell in small cages of very light wood. The sapotilles, (achras,) the mammea, pears, and raisins, occupy the bottom while the top is ornamented with odoriferous flowers. This art of entwining fruits and flowers had its origin, perhaps, in that happy period when, long before the introduction of inhuman rites, the first inhabitants of Anahuac, like the Peruvians, offered up to the great spirit Teotl the first fruits of their harvest.

These scattered features, characteristic of the natives of Mexico, belong to the Indian peasant, whose civilization, as we have already stated, is somewhat akin to that of the Chinese and Japanese. I am able only to portray still more imperfectly the manners of the pastoral Indians, whom the Spaniards include under the denomination of *Indios Bravos*, and of whom I have merely seen a few individuals, brought to the capital as prisoners of war. The Mecos (a tribe of

* 3 1-4 feet.

the Chichimecks,) the Apaches, the Lipans, are hord of hunters, who, in their incursions, for the mo part nocturnal, infest the frontiers of New Bisca Sonora, and New Mexico. These savages, as w as those of South America, display more nobility mind and more force of character than the agricu tural Indians. Some tribes of them possess even la guages of which the mechanism proves an ancie civilization. They experience great difficulty learning our European idioms, while they expre themselves in their own with great facility. The very Indian chiefs, whose solemn taciturnity ast nishes the observer, hold discourses for hours wh any great interest excites them to break their natu silence. We observed the same volubility of tongu in the missions of Spanish Guiana, and among t Caribs of the lower Orinoco, of which the langua is singularly rich and sonorous.*

*Gilij, an Italian missionary, who resided eighteen yea among the nations of the Orinoco, and became master of th languages, published three octavo volumes at Rome, in 178 1-2, which he entitled *Saggio di Storia Americana*. In the volumes there is much information with regard to the I dians, particularly those of Orinoco. From the sampl which he gives of their languages, some of them would see to be remarkably expressive, as well as sonorous, and for in the latter respect a singular contrast to those of Mexic All the words of the Orinochese languages, he says, co stantly end in vowels, and none of these languages are di cult to pronounce. But though they end in vowels, they ha nothing of the inarticulate appearance of the vowel languag of the South Sea. What wilt thou eat to-morrow? is th expressed in the Maipurese language: *Nunaunari iti pa peccari upie?* The following will serve to show the expr siveness of the Maipurese language: one who has no fath one who has no mother, one who has no wife, one who h no children: *Macchivacaneteni, matuteni, maanituteni, maa teni.*

After examining the physical constitution and intellectual faculties of the Indians, it remains for us to give a rapid survey of their social state. The history of the lower classes of a people is the relation of the events which, in creating at the same time a great inequality of fortune, enjoyment, and individual happiness, have gradually placed a part of the nation under the tutory and control of the other. We shall seek in vain this relation in the annals of history. They transmit to us the memory of the great politi-

Here are a few vocables from the Tamanac and Maipurese languages, with the corresponding ones in English.

English.	Tamanac.	Maip.
Earth	Noni	Peni
Heaven	Capu	Eno
Water	Tuno	Veni
Father	Papa	Nape
Sun	Veju	Chie
Fire	Vaplo	Catti
Bread	Ute	Ussi.

Gilij describes the nations of the Orinoco as libidinous, which sounds rather singularly applied, to Indians; and he gives a very amusing account of their powers of mimicry, and the manner in which they counterfeit the language and gestures of the missionaries, for the purpose of turning them into ridicule. One would think, almost, that the French nation had sitten for the following portrait of the Maipurese. "Generalmente adunque parlando, son gli Orinochesi di genio allegro; ma sopra ogni altra nazione spiccano i Maipuri per l'affabilità e l'amorevolezza con cui trattono i forestieri. Quindi è l'amore che portan loro gli Europei tutti, che li conoscano. Non v' ha forse Indiani, che più si affaciano all umore di ognuno. Fanno delle amicizie con tutti, ed appena trovasi in Orinoco una nazione in cui non siavi qualche Maipure. La loro lingua siccome facilissima ad imparare, è divenuta tra gli Orinochesi una lingua di moda; e chi poco, chi molto, chi mediocremente, chi bene, la parlano quasi tutti. I Maipuri nondimeno (il che toglie loro un gran pregio) sono inconstanti, poco schietti; e non tanto internamente buoni, quanto per l'innata loro civiltà compajono agli altri. Vol. ii. p. 43.

Father Gumilla speaks highly of the state of music among the tribes of the Orinoco. *Trans.*

cal revolutions, wars, conquests, and the other scourges which have inflicted humanity; but they inform us nothing of the more or less deplorable lot of the poorest and most numerous class of society. The cultivator enjoys freely, only in a very small part of Europe, the fruits of his labour; and we are forced to own that this civil liberty is not so much the result of an advanced civilization, as to the effect of those violent crises during which one class or one state has taken advantage of the dissensions of the other. The true perfection of social institutions depends no doubt on information and intellectual cultivation; but the concatenation of the springs which move a state is such, that in one part of the nation this cultivation may make a very remarkable progress without the situation of the lower orders becoming more improved. Almost the whole north of Europe confirms this sad experience. There are countries there, where, notwithstanding the boasted civilization of the higher classes of society, the peasant still lives in the same degradation under which he groaned three or four centuries ago. We should think higher, perhaps, of the situation of the Indians were we to compare it with that of the peasants of Courland, Russia, and a great part of the north of Germany.

The Indians whom we see scattered throughout the cities, and spread especially over the plains of Mexico, whose number (without including those of mixed blood) amounts to two millions and a half, are either descendants of the old peasantry, or the remains of a few great Indian families, who, disdaining alliance with the Spanish conquerors, preferred rather to cultivate with their hands the fields which were formerly cultivated for them by their vassals. This diversity has a sensible influence on the political state of the natives, and divides them into tributary and noble or cacique Indians. The latter, by the Spanish laws, ought to participate in the privileges of the Castilian nobility. But in their present situation this

is merely an illusory advantage. It is now difficult to distinguish, from their exterior, the caciques from those Indians whose ancestors in the time of Montezuma II. constituted the lower cast of the Mexican nation. The noble, from the simplicity of his dress and mode of living, and from the aspect of misery which he loves to exhibit, is easily confounded with the tributary Indian. The latter shows to the former a respect which indicates the distance prescribed by the ancient constitutions of the Aztec hierarchy. The families who enjoy the hereditary rights of *Cacicasgo*, far from protecting the tributary cast of the natives, more frequently abuse their power and their influence. Exercising the magistracy in the Indian villages, they levy the capitation tax: they not only delight in becoming the instruments of the oppressions of the whites; but they also make use of their power and authority to extort small sums for their own advantage. Well informed intendants, who have bestowed much attention for a long time to the detail of this Indian administration, assured me that the oppressions of the caciques bore very heavy on the tributary Indians. In the same manner, in many parts of Europe where the Jews are still deprived of the rights of naturalization, the rabbins oppress the members of the community confided to them. Moreover, the Aztec nobility display the same vulgarity of manners, and the same want of civilization with the lower Indians. They remain, as it were, in the same state of insulation; and examples of native Mexicans, enjoying the *Cacicasgo*, following the sword or the law are infinitely rare. We find more Indians in ecclesiastical functions, particularly in that of parish priests: the solitude of the convent appears only to have attractions for the young Indian girls.

When the Spaniards made the conquest of Mexico, they found the people in that state of abject sub-

mission and poverty which everywhere accompanies despotism and feudality. The emperor, princes, nobility, and clergy, (the teopixqui,) alone possessed the most fertile lands; the governors of provinces indulged with impunity in the most severe exactions; and the cultivator was everywhere degraded. The highways, as we have already observed, swarmed with mendicants; and the want of large quadrupeds forced thousands of Indians to perform the functions of beasts of burden, and to transport the maize, cotton, hides, and other commodities, which the more remote provinces sent by way of tribute to the capital. The conquest rendered the state of the lower people still more deplorable. The cultivator was torn from the soil, and dragged to the mountains, where the working of the mines commenced; and a great number of Indians were obliged to follow the armies, and to carry, without sufficient nourishment or repose, through mountainous woods, burdens which exceeded their strength. All Indian property, whether in land or goods, was conceived to belong to the conqueror. This atrocious principle was even sanctioned by a law, which assigns to the Indians a small portion of ground around the newly constructed churches.

The court of Spain seeing that the new continent was depopulating very rapidly, took measures, beneficial in appearance, but which the avarice and cunning of the conquerors (*conquistadores*) contrived to direct against the very people whom they were intended to relieve. The system of *encomiendas* was introduced. The Indians, whose liberty had in vain been proclaimed by Queen Isabella, were till then slaves of the whites, who appropriated them to themselves indiscriminately. By the establishment of the *encomiendas*, slavery assumed a more regular form. To terminate the quarrels among the *conquistadores*, the remains of the conquered people were shared out;

and the Indians, divided into tribes of several hundreds of families, had masters named to them in Spain from among the soldiers who had acquired distinction during the conquest, and from among the people of the law,* sent out by the court as a counterpoise to the usurping power of the generals. A great number of the finest *encomiendas* were distributed among the monks; and religion, which from its principles ought to favour liberty, was itself degraded in profiting by the servitude of the people.† This partition of the Indians attached them to the soil; and their work became the property of the *encomenderos*. The slave frequently took the family name of his master. Hence many Indian families bear Spanish names, without their blood having been in the least degree mingled with the European. The court of Madrid imagined that it had bestowed protectors on the Indians: it only made the evil worse, and gave a more systematical form to oppression.

Such was the state of the Mexican cultivators in the sixteenth and seventeenth centuries. In the eighteenth their situation assumed progressively a better appearance. The families of the *conquistadores* are partly extinguished; and the *encomiendas*, considered as fiefs, were not redistributed. The viceroys, and especially the *audiencias*, watched over the interests of the Indians; and their liberty, and, in some provinces, their ease of circumstances even,

* These powerful men frequently bore only the simple title of *licenciados*, from the degree which they had taken in their faculties.

† And yet the priests could not conceive why the people run off like *children from school*, as one of them emphatically has it! Su *ruda ignorancia* les hace proceder (aunque viejos) con las modales proprios de ninos, y con tan leve motivo, como un nino se huye de la Escuela, se huye un cacique con todos sus vasallos de un Pueblo, y queda solo el missionero: tal es su *inconstancia!!* Gumilla, vol. i. p. 117. *Trans.*

have been gradually augmenting. It was King Charles the Third especially who, by measures equally wise and energetic, became the benefactor of the Indians. He annulled the *encomiendas;* and he prohibited the *repartimientos*, by which the *corregidors* arbitrarily constituted themselves the creditors, and consequently the masters, of the industry of the natives, by furnishing them, at extravagant prices, with horses, mules and clothes, (*ropa.*) The establishment of intendancies, during the ministry of the Count de Galvez, was a memorable epoqua for Indian prosperity. The minute vexations to which the cultivator was incessantly exposed from the subaltern Spanish and Indian magistracy, have singularly diminished under the active superintendance of the intendants; and the Indians begin to enjoy advantages which laws, gentle and humane in general, afforded them, but of which they were deprived in ages of barbarity and oppression. The first choice of the persons to whom the count confided the important places of intendant or governor of a province was extremely fortunate. Among the twelve who shared the administration of the country in 1804, there was not one whom the public accused of corruption or want of integrity.

Mexico is the country of inequality. No where does there exist such a fearful difference in the distribution of fortune, civilization, cultivation of the soil, and population. The interior of the country contains four cities, which are not more than one or two days journey distant from one another, and possess a population of 35,000, 67,000, 70,000, and 135,000. The central table-land from la Puebla to Mexico, and from thence to Salamanca and Zelaya, is covered with villages and hamlets like the most cultivated parts of Lombardy. To the east and west of this narrow stripe succeed tracts of uncultivated ground, on which cannot be found ten or twelve persons to

the square league. The capital and several other cities have scientific establishments, which will bear a comparison with those of Europe. The architecture of the public and private edifices, the elegance of the furniture, the equipages, the luxury and dress of the women, the tone of society, all announce a refinement to which the nakedness, ignorance, and vulgarity of the lower people form the most striking contrast. This immense inequality of fortune does not only exist among the cast of whites, (Europeans or Creoles,) it is even discoverable among the Indians.

The Mexican Indians, when we consider them *en masse*, offer a picture of extreme misery. Banished into the most barren districts, and indolent from nature, and more still from their political situation, the natives live only from hand to mouth. We should seek almost in vain among them for individuals who enjoy any thing like a certain mediocrity of fortune. Instead, however, of a comfortable independency, we find a few families whose fortune appears so much the more colossal, as we least expect it among the lowest class of the people. In the intendancies of Oaxaca and Valladolid, in the valley of Toluca, and especially in the environs of the great city of la Puebla de los Angeles, we find several Indians, who under an appearance of poverty conceal considerable wealth. When I visited the small city of Cholula, an old Indian woman was buried there, who left to her children plantations of *maguey* (agave) worth more than 360,000 francs.* These plantations are the vineyards and sole wealth of the country. However, there are no caciques at Cholula; and the Indians there are all tributary, and distinguished for their great sobriety, and their gentle and peaceable manners. The manners of the Cholulans exhibit a singular contrast to

* 15,000l. sterling. *Trans.*

those of their neighbours of Tlascala, of whom a great number pretend to be the descendants of the highest titled nobility, and who increase their poverty by a litigious disposition and a restless and turbulent turn of mind. Among the most wealthy Indian families at Cholula are the Axcotlan, the Sarmientos and Romeros; at Guaxocingo, the Sochipiltecatl; and especially the Tecuanouegues in the village de los Reyes. Each of these families possesses a capital of from 800,000 to 1,000,000 of livres.* They enjoy, as we have already stated, great consideration among the tributary Indians; but they generally go barefooted, and covered with a Mexican tunic of coarse texture and a brown colour, approaching to black, in the same way as the very lowest of the Indians are usually dressed.

The Indians are exempted from every sort of indirect impost. They pay no *alcavala;* and the law allows them full liberty for the sale of their productions. The supreme council of finances of Mexico, called the *Junta superior de Real Hacienda*, endeavoured from time to time, especially within these last five or six years, to subject the Indians to the alcavala. We must hope that the court of Madrid, which in all times has endeavoured to protect this unfortunate race, will preserve to them their immunity so long as they shall continue subject to the direct impost of the *tributos*. This impost is a real capitation tax, paid by the male Indians between the ages of ten and fifty. The tribute is not the same in all the provinces of New Spain; and it has been diminished within the last two hundred years. In 1601, the Indian paid yearly 32 reals of plata of *tributo*, and four reals of *servicio real*, in all nearly 23 francs.† It was gradually reduced in some intendancies to 15

* From 33,336l. to 41,670l. sterling. *Trans.*

† 19s. 2d. *Trans.*

and even to five* francs.† In the bishopric of Mechoacan, and in the greatest part of Mexico, the capitation amounts at present to 11 francs.‡ Besides, the Indians pay a parochial duty (*derechos parroquiales*) of 10 francs for baptism, 20 francs for a certificate of marriage, and 20 francs for interment. We must also add to these 61 francs, which the church levies as an impost on every individual, from 25 to 30 francs for offerings which are called voluntary, and which go under the names of *cargos de cofradias*, *responsos* and *misas para sacar animas*.§

If the legislation of Queen Isabella and the Emperor Charles V. appears to favour the Indians with regard to imposts, it has deprived them, on the other hand, of the most important rights enjoyed by the other citizens. In an age when it was formally discussed if the Indians were rational beings, it was

* 12s. 6d. and 4s. 2d. *Trans.*

† Compendio de la historia de la *Real Hacienda de Nueva Espana*, a manuscript work presented by Don Joacquin Maniau, in 1793, to the Secretary of State Don Diego de Gardoqui, of which there is a copy in the archives of the viceroyalty.

‡ 9s. 2d. *Trans.*

§ The Spanish clergy seem to have been perfectly disposed to make the Indians pay pretty well beforehand in earthly treasure for the heavenly felicity (*eterna dicha*) they communicated to them. But what were these trifles when weighed in the balance with the immensity of the benefits imported by the catholic arms into these provinces? "El feliz tiempo," exclaims the reverend Father Gumilla, "para tantos millones de Indios, como yá, por la Bondad de Dios, se han salvado, y salvan (aunque infeliz para los que aun estan en su ciega ignorancia, o ciegamente resisten a la luz evangelica) empezó desde que las armas catholicas tomaron possession de las principales provincias de aquellos dos vastos imperios, y prosiegue hasta ahora, creciendo siempre en todos angulos del Nuevo mundo la luz de la Santa Fe, para *eterna dicha* de aquellos infelices hijos d'Adan, (vol. i. p. 74.) *Trans.*

conceived granting them a benefit to treat them like minors, to put them under the perpetual tutory of the whites, and to declare null every act signed by a native of the copper-coloured race, and every obligation which he contracted beyond the value of 15 francs. These laws are maintained in full vigour; and they place insurmountable barriers between the Indians and the other casts, with whom all intercourse is almost prohibited. Thousands of inhabitants can enter into no contract which is binding; (*no pueden tratar y contratar;*) and condemned to a perpetual minority, they become a charge to themselves and the state in which they live. I cannot better finish the political view of the Indians of New Spain than by laying before the reader an extract from a memoir presented by the bishop and chapter of Mechoacan* to the king, in 1799, which breathes the wisest views, and the most liberal ideas.

This respectable bishop,† whom I had the advantage of knowing personally, and who terminated his useful and laborious life at the advanced age of

* *Informe del Obispo y Cabildo eclesiastico de Valladolid de Mechoacan al Rey sobre Jurisdiccion y Ymunidades del Clero Americano.* This report, which I possess in manuscript, containing more than 10 sheets, was drawn up on the occasion of the famous *Cedula real* of the 25th October, 1795, which permitted the secular judge to try the *delittos enormes* of the clergy. The *Sala del crimen*, persuaded of their right, treated the priests with severity, and cast them into the same prisons with the lowest classes of the people. In this struggle, the *audiencia* ranged themselves on the side of the clergy. Disputes of jurisdiction are very common in distant countries. They are pursued with so much the greater keenness, as the European policy, from the first discovery of the new world, has always considered the disunion of casts, of families, and constituted authorities, the surest means of preserving the colonies in a dependence on the mother country.

† *Fray Antonio de San Miguel*, monk of St. Jerome de Corvan, native of the *Montanas de Santander.*

80, represents to the monarch, that in the actual state of things the moral improvement of the Indian is impossible, if the obstacles are not removed which oppose the progress of national industry. He confirms the principles which he lays down by several passages from the works of Montesquieu and Bernardin de St. Pierre. These citations can hardly fail to surprise us from the pen of a prelate belonging to the regular clergy, who passed a part of his life in convents, and who filled an episcopal chair on the shores of the South Sea. "The population of New Spain," says the bishop, towards the end of his memoir, "is composed of three classes of men, whites or Spaniards, Indians and castes. I suppose the Spaniards to compose the tenth part of the whole mass. In their hands almost all the property and all the wealth of the kingdom are centered. The Indians and the castes cultivate the soil; they are in the service of the better sort of people; and they live by the work of their hands. Hence there results between the Indians and the whites that opposition of interests, and that mutual hatred, which universally takes place between those who possess all and those who possess nothing, between masters and those who live in servitude. Thus we see, on the one hand, the effects of envy and discord, deception, theft, and the inclination to prejudice the interests of the rich; and on the other, arrogance, severity, and the desire of taking every moment advantage of the helplessness of the Indian. I am not ignorant that these evils everywhere spring from a great inequality of condition. But in America they are rendered still more terrific, because there exists no intermediate state; we are rich or miserable, noble or degraded, by the laws or the force of opinion, (*infame de derecho y hecho.*)

"In fact, the Indians and the races of mixed blood (*castas*) are in a state of extreme humiliation. The

colour peculiar to the Indians, their ignorance, and especially their poverty, remove them to an infinite distance from the whites, who occupy the first rank in the population of New Spain. The privileges which the laws seem to concede to the Indians are of small advantage to them, perhaps they are rather hurtful. Shut up in a narrow space of 600 varas (500 metres*) of radius, assigned by an ancient law to the Indian villages, the natives may be said to have no individual property, and are bound to cultivate the common property, (*bienes de communidad.*) This cultivation is a load so much the more insupportable to them, as they have now for several years back lost all hopes of ever being able to enjoy the fruit of their labour. The new arrangement of intendancies bears, that the natives can receive no assistance from the funds of the communalty without a special permission of the board of finances of Mexico, ("*junta superior de la Real Hacienda.*") (The communal property has been farmed out by the intendants; and the produce of the labour of the natives is poured into the royal treasury, where the *oficiales reales* keep an account, under special heads, of what they call the property of each village. I say what they call the property, for this property is nothing more than a fiction for these last twenty years. The intendant even cannot dispose of it in favour of the natives, who are wearied of demanding assistance from the communalty funds. The *junta de Real Hacienda* demands *informes* from the *fiscal* and the *asesor* of the viceroy. Whole years pass in accumulating documents, but the Indians remain without any answer. The money of the *caxas de communidades* is so habitually considered as having no fixed destination, that the intendant of Valladolid

* 1,640 feet. *Trans.*

sent in 1798 more than a million of francs* to Madrid, which had been accumulating for twelve years. The king was told that it was a gratuitous and patriotic gift from the Indians of Mechoacan to the sovereign, to aid in the prosecution of the war against England!)

"The law prohibits the mixture of casts; it prohibits the whites from taking up their residence in Indian villages; and it prevents the natives from establishing themselves among the Spaniards. This state of insulation opposes obstacles to civilization. The Indians are governed by themselves; all their subaltern magistrates are of the copper-coloured race. In every village we find eight or ten old Indians who live at the expense of the rest, in the most complete idleness, whose authority is founded either on a pretended elevation of birth, or on a cunning policy transmitted from father to son. These chiefs, generally the only inhabitants of the village who speak Spanish, have the greatest interest in maintaining their fellow-citizens in the most profound ignorance; and they contribute the most to perpetuate prejudices, ignorance, and the ancient barbarity of manners.

"Incapable, from the Indian laws, of entering into any contract, or running in debt to the extent of more than five piastres, the natives can only attain to an amelioration of their lot, and enjoy some sort of comfort as common labourers, or as artisans. Solorzano, Fraso, and other Spanish authors, have in vain endeavoured to investigate the secret cause why the privileges conceded to the Indians have constantly produced the most unfavourable effects to them. I am astonished that these celebrated jurisconsults never conceived that what they call a secret cause springs from the very nature of these privileges.

* 41,670l. sterling. *Trans.*

They are arms which never have served for the protection of those which they were destined to defend, and which the citizens of the other casts could not fail to employ against the Indian race. Such a union of deplorable circumstances has produced in them an indolence of mind, and that state of indifference and apathy in which man is neither affected by hope nor fear.

"The *casts*, descendants of negro slaves, are branded with infamy by the law, and are subjected to *tribute*. This direct impost imprints on them an indelible stain; they consider it as a mark of slavery transmissible to the latest generations. Among the mixed race, among the mestizoes and mulattoes, there are many families, who, from their colour, their physiognomy, and their cultivation, might be confounded with the Spaniards; but the law keeps them in a state of degradation and contempt. Endowed with an energetic and ardent character, these men of colour live in a constant state of irritation against the whites; and we must be astonished that their resentment does not more frequently dispose them to acts of vengeance.

"The Indians and the *casts* are in the hands of the magistrates of districts (*justicias territoriales*) whose immorality has not a little contributed to their misery. So long as the *alcaldias mayores* subsisted in Mexico, the alcaldes considered themselves as merchants who had acquired an exclusive privilege of buying and selling in their provinces, and who could draw from this privilege, in some sort or other, from 30,000 to 200,000 piastres, from 150,000 to 1,000,000 francs,* and what is more, in the short space of five years. These usurious magistrates compelled the Indians to purchase, at arbitrary prices, a certain number of cattle. By this means the na-

* From 6,250l. to 41,670l. sterling. *Trans.*

tives became their debtors. Under the pretext of recovering the capital and usury, the *alcalde mayor* disposed of the Indians, the whole year round, as true slaves. The individual happiness of these unfortunate wretches was not certainly increased by the sacrifice of their liberty, for a horse or a mule to work for their master's profit. But yet in the midst of this state of things, brought on by abuses, agriculture and industry were seen to increase.

"On the establishment of intendancies, the government wished to put an end to the oppressions which arose from the *repartimientos*. In place of *alcaldes mayores*, they named *subdelegados*, subaltern magistrates, to whom every sort of traffic was prohibited. As no salaries were assigned to them, or any sort of fixed emolument, the evil has become worse. The *alcaldes mayores* administered justice with impartiality, whenever their own interests were not concerned. The subdelegates of the intendants having no other revenues but casualties, believed themselves authorized to employ illicit means to procure themselves a comfortable subsistence. Hence the perpetual oppressions and the abuses of authority to which the poor were subject; and hence the indulgence towards the rich, and the shameful traffic of justice. The intendants find the greatest difficulties in the choice of the *subdelegados*, from whom, in the actual state of things, the Indians can neither expect support nor protection. That support and that protection they seek from the clergy; and hence the constant opposition in which the clergy and subdelegates usually live. However the natives place more confidence in the clergy and magistrates of a superior rank, the intendants and the *oidores*, (members of the *audiencia*.) Now, Sire, what attachment can the Indian have to the government, despised and degraded as he is, and almost without property and without hope of ameliorating his existence? He is merely at-

tached to social life by a tie which affords him advantage. Let not your majesty believe, that dread of punishment alone is sufficient to pres tranquillity in this country: there must be other tives, there must be more powerful motives. I new legislation which Spain expects with impati do not occupy itself with the situation of the Ind and people of colour, the influence which the gy possess over the hearts of these unfortunate pe however great it may be, will not be suffi to contain them in the submission and res due to their sovereign.

"Let the odious personal impost of the *tribut* abolished; and let the infamy (*infamia de dere* which unjust laws have attempted to stamp on people of colour be at an end; let them be decl capable of filling every civil employment w does not require a special title of nobility; let a tion of the demesnes of the crown, (*tierras re guas,*) which are generally uncultivated, be gra to the Indians and the *casts;* let an agrarian law passed for Mexico similar to that of the Asturias Gallicia, by which the poor cultivator is permitte bring in under certain conditions the land which great proprietors have left so many ages uncul ted to the detriment of the national industry; let liberty be granted to the Indians, the *casts*, and whites to settle in villages which at present be only to one of these classes; let salaries be appoi for all judges and all magistrates of districts; th Sire, are the six principal points on which the feli of the Mexican people depends.

"It appears strange, no doubt, that, in a junc when the finances of the state are in a deplorable tuation, we presume to propose to your majesty abolition of the tribute. A very simple calcula will prove, however, that the adoption of the sures above indicated, and the conceding to the In all the rights of denizens, will increase consider

GEO. W. CLARKE
MEXICO
THE TWO REPUBLICS

instead of diminishing the revenues of the state (Real Hacienda.") The bishop supposes 810,000 families of Indians and men of colour in the whole extent of New Spain. Several of these families, especially those of mixed blood, are clothed and enjoy some degree of comfort. They live nearly in the manner of the lower people of the peninsula; and their number is a third of the whole mass. The annual consumption of this third part may be estimated at 300 piastres per family.* Reckoning for the other thirds only 60† piastres,‡ and supposing the Indians to pay the *alcavala* of 14 per cent. like the whites, an annual revenue would be raised of 5,000,000 of piastres,§ a much greater revenue than the quadruple of the present value of the *tributes*. We will not guaranty the accuracy of the numbers on which this calculation is founded; but a simple sketch may suffice to prove, that on establishing an equality of duties and imposts among the different classes of people, not only the abolition of the capitation would create no deficit in the crown revenues, but that these revenues would necessarily increase with the increase of comfort and prosperity among the natives.

We might have hoped that the administrations of three enlightened viceroys, animated with the most noble zeal for the public good, the Marquis de Croix, the Count de Revillagigedo, and the Chevalier d'Asanza, would have produced some happy changes in the political state of the Indians; but these hopes have been frustrated. The power of the viceroys

* 67*l.* 12*s.* 6*d.* sterling. *Trans.* † 13*l.* 2*s.* 6*d.* sterling. *Trans.*

‡ It is computed that in the warm region of Mexico, a day labourer requires annually for himself and family, in nourishment and clothes, 72 piastres. The luxury is nearly 20 piastres less in the cold region of the country.

§ 1,093,750*l.* sterling.

has been singularly diminished of late: they are fettered in all their measures, not only by the *junta* of finances, (*de Real Hacienda*,) and by the high court of justice, (*Audiencia*,) but also by the government in the mother country, which possesses the mania of wishing to govern in the greatest detail provinces at the distance of two thousand leagues, the physical and moral state of which are equally unknown to them. The philanthropists affirm, that it is happy for the Indians that they are neglected in Europe, because sad experience has proved that the most part of the measures adopted for their relief have produced an opposite effect. The lawyers, who detest innovations, and the Creole proprietors, who frequently find their interest in keeping the cultivator in degradation and misery, maintain that we must not interfere with the natives, because, on granting them more liberty, the whites would have every thing to fear from the vindictive spirit and arrogance of the Indian race. The language is always the same whenever it is proposed to allow the peasant to participate in the rights of a free man and a citizen. I have heard the same arguments repeated in Mexico, Peru, and the kingdom of New Granada, which, in several parts of Germany, Poland, Livonia, and Russia, are opposed to the abolition of slavery among the peasants.

Recent examples ought to teach us how dangerous it is to allow the Indians to form a *status* in *statu*, to perpetuate their insulation, barbarity of manners, misery, and consequently motives of hatred against the other casts. These very stupid indolent Indians, who suffer themselves patiently to be lashed at the church doors, appear cunning, active, impetuous, and cruel, whenever they act in a body in popular disturbances. It may be useful to relate a proof of this assertion. The great revolt in 1781 very nearly deprived the king of Spain of all the mountainous part of Peru, at the period when Great Britain lost

nearly all her colonies in the continent of America. Jose Gabriel Condorcanqui, known by the name of the Inca Tupac-Amaru, appeared at the head of an Indian army before the walls of Cusco. He was the son of the cacique of Tongasuca, a village of the province of Tinta, or rather the son of the cacique's wife; for it is certain that the pretended Inca was a Mestizo, and that his true father was a monk. The Condorcanqui family traces its origin up to the Inca Sayri-Tupac, who disappeared in the thick forests to the east of Villcapampa, and to the Inca Tupac-Amaru, who, contrary to the orders of Philip the Second, was decapitated in 1578 under the viceroy Don Francisco de Toledo.

Jose Gabriel was carefully educated at Lima; and he returned to the mountains, after having in vain solicited from the court of Spain the title of Marquis d'Oropesa, which belongs to the family of the Inca Sayri-Tupac. His spirit of vengeance drove him to excite the highland Indians, irritated against the corregidor Arriaga, to insurrection. The people acknowledged him as a descendant of their true sovereigns, and as one of the children of the sun. The young man took advantage of the popular enthusiasm which he had excited by the symbols of the ancient grandeur of the empire of Cusco; he frequently bound round his forehead the imperial fillet of the Incas; and he artfully mingled christian ideas with the memorials of the worship of the sun.

In the commencement of his campaigns he protected ecclesiastics and Americans of all colours. As he only broke out against Europeans, he made a party even among the Mestizoes and the Creoles; but the Indians, distrusting the sincerity of their new allies, soon began a war of extermination against every one not of their own race. Jose Gabriel Tupac-Amaru, of whom I possess letters in which he styles

himself Inca of Peru, was not so cruel as his brother Diego, and especially his nephew Andres Condorcanqui, who, at the age of 17, displayed great talents but a sanguinary character. This insurrection, which appears to be very little known in Europe, lasted nearly two years. I shall give more minute information with regard to it in the historical account of my travels. Tupac-Amaru had made himself master of the provinces of Quispicanchi, Tinta, Lampa, Azangara, Caravaja and Chumbivilcas, when the Spaniards made him and his family prisoners. They were all quartered in the city of Cusco.

The respect with which the pretended Inca had inspired the natives was so great, that, notwithstanding their fear of the Spaniards, and though they were surrounded by the soldiers of the victorious army, they prostrated themselves at the sight of the last of the children of the sun, as he passed along the streets to the place of execution. The brother of Jose Gabriel Condorcanqui, known by the name of Diego Christobal Tupac-Amaru, was executed long after the termination of this revolutionary movement of the Peruvian Indians. When the chief fell into the hands of the Spaniards, Diego surrendered himself voluntarily, to profit by the pardon promised him in the name of the king. A formal convention was signed between him and the Spanish general, on the 20th January, 1782, at the Indian village of Siquani, situated in the province of Tinta. He lived tranquilly in his family, till, through an insidious and distrustful policy, he was arrested on pretext of a new conspiracy.

The horrors exercised by the natives of Peru towards the whites in 1781 and 1782 in the Cordillera of the Andes were repeated in part, twenty years after, in the trifling insurrections which took place in the plain of Riobamba. It is therefore of the great-

est importance, even for the security of the European families established for ages in the continent of the new world, that they should interest themselves in the Indians, and rescue them from their present barbarous, abject, and miserable condition.

CHAPTER VII.

Whites, Creoles, and Europeans. Their civilization. Inequality of their fortunes. Negroes. Mixed casts. Proportion between the sexes. Longevity according to the difference of races. Sociability.

AMONGST the inhabitants of pure origin the whites would occupy the second place, considering them only in the relation of number. They are divided into whites born in Europe, and descendants of Europeans born in the Spanish colonies of America or in the Asiatic islands. The former bear the name of *Chapetones* or *Gachupines*, and the second that of *Criollos*. The natives of the Canary islands, who go under the general denomination of *Islenos*, (islanders,) and who are the *gerans* of the plantations, are considered as Europeans. The Spanish laws allow the same rights to all whites; but those who have the execution of the laws endeavour to destroy an equality which shocks the European pride. The government, suspicious of the Creoles, bestows the great places exclusively on the natives of Old Spain. For some years back they have disposed at Madrid even of the most trifling employments in the administration of the customs and the tobacco revenue. At an epoch when every thing tended to a uniform relaxation in the springs of the state, the system of venality

made an alarming progress. For the most part it was by no means a suspicious and distrustful policy; it was pecuniary interest alone which bestowed all employments on Europeans. The result has been a jealous and perpetual hatred between the Chapetons and the Creoles. The most miserable European, without education, and without intellectual cultivation, thinks himself superior to the whites born in the new continent. He knows that, protected by his countrymen, and favoured by chances common enough in a country where fortunes are as rapidly acquired as they are lost, he may one day reach places to which the access is almost interdicted to the natives, even to those of them distinguished for their talents, knowledge and moral qualities. The natives prefer the denomination of *Americans* to that of Creoles. Since the peace of Versailles, and, in particular, since the year 1789, we frequently hear proudly declared, "I am not a *Spaniard*, I am an *American!*" words which betray the workings of a long resentment. In the eye of law every white Creole is a Spaniard; but the abuse of the laws, the false measures of the colonial government, the example of the United States of America, and the influence of the opinions of the age, have relaxed the ties which formerly united more closely the Spanish Creoles to the European Spaniards. A wise administration may re-establish harmony, calm their passions and resentments, and yet preserve for a long time the union among the members of one and the same great family scattered over Europe and America, from the Patagonian coast to the north of California.

The number of individuals of whom the white race is composed (*Casta de los blancos o de los Espanoles*) amounts, probably, in all New Spain, to 1,200,000, of whom nearly the fourth part inhabited the *provincias internas*. In New Biscay, or in the intendancy of Durango, there is hardly an individual subject to the

tributo. Almost all the inhabitants of these northern regions pretend to be of pure European extraction. In the year 1793 they reckoned:

	Souls.	*Spaniards.*
In the intendancy of Guanaxuato on a total population of . . .	398,000	103,000
Valladolid . . .	290,000	80,000
Puebla	638,000	63,000
Oaxaca . . .	411,000	26,000

Such is the simple result of the enumeration, making none of the changes requisite from the imperfection of that operation which we discussed in the fifth chapter. Consequently, in the four intendancies adjoining the capital, we find 272,000 whites, either Europeans or descendants of Europeans, in a total population of 2,737,000 souls. For every hundred inhabitants, there were:

In the intendancy of Valladolid,	. 27 whites.
Guanaxuato	. 25
Puebla	. 9
Oaxaca	. 6

These considerable differences show the degree of civilization to which the ancient Mexicans had attained south from the capital. These southern regions were always the best inhabited. In the north, as we have already several times observed in the course of this work, the Indian population was more thinly sown. Agriculture has only begun to make any progress there since the period of the conquest.

It is curious to compare together the number of whites in the West Indies and in Mexico. The French part of St. Domingo contained in its happiest æra, 1788, on a surface of 1,700 square leagues (25 to the degree) a smaller population than that of the inten-

dancy of la Puebla. Page* estimates the population of St. Domingo at 520,000 inhabitants, among whom there were 40,000 whites, 28,000 people of colour, and 452,000 slaves. Hence, in St. Domingo, in every 100 souls, eight were white, six free people of colour, and eighty-six African slaves. Jamaica was computed in 1787 to have in every 100 inhabitants, ten whites, four people of colour, and eighty-six slaves; and yet this English colony possesses a smaller population by one-third than the intendancy of Oaxaca. Hence, the disproportion between the Europeans or their descendants, and the casts of Indian or African blood, is still greater in the southern part of New Spain than in the French and English sugar islands. The island of Cuba, on the contrary, exhibits even at this day in the distribution of the races a very great and a very consolatory difference. From the most careful statistical researches which I was enabled to make during my stay at the Havannah, in 1800 and 1804, I found that at the last of these epochs the total population of the island of Cuba amounted to 432,000 souls, among whom there were

A. Freemen,	-	-	324,000
Whites	-	234,000	
People of colour		90,000	
B. Slaves	-	-	108,000
		Total	432,000

or in every 100 inhabitants, fifty-four Creole and

* Vol. ii. p. 5. In 1802 there were in the whole island of St. Domingo only 375,000 inhabitants, whereof 290,000 were labourers, 47,000 domestics, artisans, and sailors, and 37,000 soldiers. To what a degree must the population have diminished within the last six years! In the island of Barbadoes, the number of whites is greater than in any of the other islands; it amounts to 16,000, on a total population of 80,000.

European whites, twenty-one men of colour, and twenty-five slaves. The proportion of freemen to slaves is there as three to one, while at Jamaica they are as one to six.

The following table exhibits the proportion of the other casts to the whites in the different parts of the new continent. Out of every 100 inhabitants, we reckon

In the United States of North America - -	83 whites,
Island of Cuba -	54
Kingdom of New Spain (without including the *provincias internas*)	16
Kingdom of Peru -	12
Island of Jamaica - -	10

In the capital of Mexico, according to the enumeration of the Count de Revillagigedo, in every 100 inhabitants, 49 are Spanish Creoles, two Spaniards born in Europe, twenty-four Aztec and Otomite Indians, and twenty-five people of mixed blood. The exact knowledge of these proportions is of the utmost importance to those who have the superintendance of the colonies.

It would be difficult to estimate exactly how many Europeans there are among the 1,200,000 whites who inhabit New Spain. As in the capital of Mexico itself, where the government brings together the greatest number of Spaniards, in a population of more than 135,000 souls, not more than 2,500 individuals are born in Europe, it is more than probable that the whole kingdom does not contain more than 70 or 80,000. They constitute, therefore, only the 70th part of the whole population, and the proportion of Europeans to white Creoles is as one to fourteen.

The Spanish laws prohibit all entry into the American possessions to every European not born in the peninsula. The words European and Spaniard are become synonymous in Mexico and Peru. The inhabitants of the remote provinces have therefore a difficulty in conceiving that there can be Europeans who do not speak their language; and they consider this ignorance as a mark of low extraction, because, everywhere around them, all, except the very lowest class of the people, speak Spanish. Better acquainted with the history of the sixteenth century than with that of our own times, they imagine that Spain continues to possess a decided preponderance over the rest of Europe. To them the peninsula appears the very centre of European civilization. It is otherwise with the Americans of the capital. Those of them who are acquainted with the French or English literature fall easily into a contrary extreme; and have still a more unfavourable opinion of the mother country than the French had at a time when communication was less frequent between Spain and the rest of Europe. They prefer strangers from other countries to the Spaniards; and they flatter themselves with the idea that intellectual cultivation has made more rapid progress in the colonies than in the peninsula.

This progress is indeed very remarkable at the Havannah, Lima, Sante Fe, Quito, Popayan, and Caraccas. Of all these great cities the Havannah bears the greatest resemblance to those of Europe in customs, refinements of luxury, and the tone of society. At Havannah, the state of politics and their influence on commerce is best understood. However, notwithstanding the efforts of the *patriotic society of the island of Cuba*, which encourages the sciences with the most generous zeal, they prosper very slowly in a country where cultivation and the price of colonial produce engross the whole attention of the inhabitants. The study of the mathematics, che-

of the country, at the farm of Santiago Acebedocla, near the Indian village of Tizicapan; and he had the merit, we may say, of forming himself. At the age of four he communicated the small-pox to his father, who died of them. An uncle, parish priest of Xaltocan, took care of his education, and placed him under the instruction of an Indian of the name of Manuel Asentzio; a man of great natural strength of mind, and well versed in the knowledge of the Mexican history and mythology. Velasquez learned at Xaltocan several Indian languages, and the use of the hieroglyphical writings of the Aztecs. It is to be regretted that he published nothing on this very interesting branch of antiquity. Placed at Mexico in the Tridentine College, he found neither professor, nor book, nor instruments.* With the small assistance which he could obtain, he fortified himself in the study of the mathematics and the ancient languages. A lucky accident threw into his hands the works of Newton and Bacon. He drew from the one a taste for astronomy, and from the other an acquaintance with the true methods of philosophising. While poor and unable to find any instrument even in Mexico, he set himself, with his friend M. Guadalaxara, (now professor of mathematics in the Academy of Painting,) to construct telescopes and quadrants. He followed at the same time the profession of advocate, an occupation which at Mexico, as well as elsewhere, is much more lucrative than that of looking at the stars. What he gained by his professional labours was laid out in purchasing instruments in England. After being named professor

* From this we may discover that the professors of this university are not behind those of some others in the praiseworthy custom of considering their chairs as sinecures. *Trans.*

in the university, he accompanied the *visitador* Don Jose de Galvez* in his journey to Sonora. Sent on a commission to California, he profited by the serenity of the sky in that peninsula to make a great number of astronomical observations. He first observed there that in all the maps, for centuries, through an enormous error of longitude, this part of the new continent had always been marked several degrees farther west than it really was. When the Abbé Chappe, more celebrated for his courage and his zeal for the sciences than for the accuracy of his labours, arrived in California, he found the Mexican astronomer already established there. Velasquez had constructed for himself in Mimosa planks an observatory at St. Anne. Having already determined the position of this Indian village, he informed the Abbé Chappe that the moon's eclipse on the 18th June, 1769, would be visible in California. The French astronomer doubted the truth of this assertion till the eclipse actually took place. Velasquez by himself made a very good observation of the transit of Venus over the disk of the sun on the 3d June, 1769. He communicated the result, the very morning of the transit, to the Abbé Chappe, and to the Spanish astronomers Don Vicente Doz, and Don Salvador de Medina. The French traveller was surprised at the harmony between the ob-

* The Count de Galvez, before obtaining the ministry of the Indies, travelled through the northern part of New Spain with the title of *visitador*. This name is given to persons employed by the court to procure information as to the state of the colonies. Their journey (*visita*) has generally no other effect than that of counterbalancing for some time the power of the viceroys and the *audiencias*, of receiving an infinity of memoirs, petitions, and projects, and of signalizing their stay by the introduction of some new impost. The people expect the arrival of the *visitadores* with the same impatience which they afterwards display for their departure.

servation of Velasquez and his own. He was no doubt astonished to meet in California with a Mexican, who, without belonging to any academy, and without having ever left New Spain, was able to observe as well as the academicians. In 1773 Velasquez executed the great geodæsical undertaking, of which we have given some of the results in the geographical introduction, and to which we shall again return in speaking of the drain of the lakes of the valley of Mexico. The most essential service which this indefatigable man rendered to his country was the establishment of the *Tribunal* and the Schools of Mines, the plans for which he presented to the court. He finished his laborious career on the 6th March, 1786, while first director-general of the *Tribunal de Mineria*, and enjoying the title of *Alcalde del Corte Honorario*.

After mentioning the labours of Alzate and Velasquez, it would be unjust to pass over the name of Gama, the friend and fellow-labourer of the latter. Without fortune, and compelled to support a numerous family by a troublesome and almost mechanical labour, unknown and neglected during his life by his fellow-citizens,* who loaded him with eulogies after his death, Gama became by his own unassisted efforts an able and well informed astronomer. He published several memoirs on eclipses of the moon, on the satellites of Jupiter, on the almanack and chronology of the ancient Mexicans, and on the climate of New Spain; all of which announce a great precision of ideas and accuracy of observation. If I have allowed myself to enter into these details on the literary merit of three Mexican *savans*, it is merely for the sake of proving from their example, that the igno-

* The celebrated navigator, Alexander Malaspina, during his stay at Mexico, observed along with Gama. He recommended him with much warmth to the court, as is proved by the official letters of Malaspina, preserved in the archives of the viceroy.

rance which European pride has thought proper to attach to the Creoles is neither the effect of the climate nor of a want of moral energy; but that this ignorance, where it is still observable, is solely the effect of the insulation, and the defects in the social institutions of the colonies.

If, in the present state of things, the cast of whites is the only one in which we find almost exclusively any thing like intellectual cultivation, it is also the only one which possesses great wealth. This wealth is unfortunately still more unequally distributed in Mexico than in the *capitania general* of Caraccas, the Havannah, and especially Peru. At Caraccas, the heads of the richest families possess a revenue of 200,000 livres.* In the island of Cuba we find revenues of more than 6 or 700,000 francs.† In these two industrious colonies, agriculture has founded more considerable fortunes than has been accumulated by the working of the mines in Peru. At Lima an annual revenue of 80,000 francs, is very uncommon.‡ I know in reality of no Peruvian family in the possession of a fixed and sure revenue of 130,000 francs.§ But in New Spain there are individuals who possess no mines, whose revenue amounts to a million of francs.‖ The family of the Count *de la Valenciana*, for example, possesses alone, on the ridge of the Cordillera, a property worth more than 25 millions of francs,¶ without including the mine of Valenciana near Guanaxuato, which, *communibus annis*, yields a net revenue of a million and a half of livres.** This family, of which the

* 8,334*l.* sterling. *Trans.*

† 25,002*l.* or 29,169*l.* sterling. *Trans.*

‡ 3,333*l.* sterling. *Trans.* § 5,417*l.* sterling. *Trans.*

‖ 41,670*l.* sterling. *Trans.* ¶ 1,041,750*l.* sterling. *Trans.*

** 62,505*l.* sterling. *Trans.*

The Duke of Monteleon a Neapolitan lord, who is now the head of the house of Cortez, possesses superb estates in the province of Oaxaca, near Toluca, and at Cuernavaca. The net produce of his rents is actually no more than 550,000 francs,* the king having deprived the duke of the collection of the alcavalas and the duties on tobacco. The ordinary expenses of management amount to more than 125,000 francs.† However, several governors of the marquesado have become singularly wealthy. If the descendants of the great *conquistador* would only live in Mexico, their revenue would immediately rise to more than a million and a half.‡

To complete the view of the immense wealth centered in the hands of a few individuals in New Spain, which may compete with any thing in Great Britain, or the European possessions in Hindostan, I shall add several exact statements both of the revenues of the Mexican clergy, and the pecuniary sacrifices annually made by the body of miners (*cuerpo de mineria*) for the improvement of mining. This last body, formed by a union of the proprietors of mines, and represented by deputies who sit in the *Tribunal de Mineria*, advanced in three years, between 1784 and 1787, a sum of four millions of francs§ to individuals who were in want of the necessary funds to carry on great works. It is believed in the country that this money has not been very usefully employed; (*para habilitar;*) but its distribution proves the generosity and opulence of those who are able to make such considerable largesses. A European reader will be still more astonished when I inform him of the extraordinary fact, that the respectable family of Fa-

* 22,918l. sterling. *Trans.*

† 5,208l. sterling. *Trans.* ‡ 62,505l. sterling. *Trans.*

§ 166,680l. sterling. *Trans.*

goagas lent, a few years ago, without interest, a sum of more than three millions and a half of francs* to a friend, whose fortune they were in the belief would be made by it in a solid manner; and this sum was irrevocably lost in an unsuccessful new mining undertaking. The architectural works which are carried on in the capital of Mexico for the embellishment of the city are so expensive, that notwithstanding the low rate of wages, the superb edifice constructed by order of the *Tribunal de Mineria* for the School of Mines will cost at least three millions of francs,† of which two millions were in readiness before the foundation was laid. To hasten the construction, and particularly to furnish the students immediately with a proper laboratory for metallic experiments on the amalgamation of great masses of minerals, (*beneficio de patio,*) the body of Mexican miners contributed monthly, in the year 1803 alone, the sum of 50,000 livres.‡ Such is the facility with which vast projects are executed in a country where wealth is divided among a small number of individuals.

This inequality of fortune is still more conspicuous among the clergy, of whom a number suffer extreme poverty, while others possess revenues which surpass those of many of the sovereign princes of Germany. The Mexican clergy, less numerous than is believed in Europe, is only composed of ten thousand individuals, the half of whom are regulars who wear the cowl. If we include lay brothers and sisters, or servants, (*legos, donados y criados de los conventos,*) all those who are not in orders, we may estimate the clergy at 13 or 14,000 individuals.§

* 145,845l.

† 125,010l. sterling. *Trans.* ‡ 2,083l. sterling.

§ The number of monks of St. Francis in Spain amounts to 15,600, more than all the ecclesiastics of the kingdom of Mexico. The clergy in the peninsula exceed 238,000 indi-

Now the annual revenue of the eight Mexican bishops in the following list, amounts to a total sum of 2,695,000 francs:*

Revenues of the Archbishop of		Double piastres.
Mexico	130,000	-
Bishop of la Puebla	110,000	-
Valladolid	100,000	-
Guadalaxara	90,000	-
Durango	35,000	-
Monterey	30,000	-
Yucatan	20,000	-
Oaxaca	18,000	-
Sonora	6,000	-
	539,000†	

viduals. For every thousand inhabitants there are 20 ecclesiastics, while in New Spain there are not above two to the thousand. The following is a specification of the clergy in several of the intendancies, according to the enumeration in 1793:

In the intendancy of la Puebla	667	secular ecclesiastics, or *clerigos*, and	881 regulars.
Valladolid	293	- -	298
Guanaxuato	225	- -	197
Oaxaca	306	- -	342
In the city of Mexico	550	- -	1646

Including in the enumeration the *Donados*, or lay brothers, the convents of the capital contain more than 2,500 individuals.—*Author.*

The clergy of the peninsula, according to M. de La Borde, from whom M. de Humboldt elsewhere professes to take his information regarding Spain, amounts to 147,657 individuals; and, according to M. Townsend, who cites the returns made

* 112,300*l.* sterling. *Trans.*

† This, at the rate of conversion which the author lays down in a note in the following page, namely, five francs five sous per double piastre, does not amount to the sum of 2,695,000, but 2,829,750 francs=117,915*l.*—*Trans.*

The bishop of Sonora, the poorest of them all, does not draw tithes. He is paid like the bishop of Panama immediately by the king, (*de Cajas reales.*) His income amounts only to the 20th part of that of the bishops of Valladolid and Mechoacan; and, what is truly distressing in the diocese of an archbishop whose revenue amounts to the sum of 650,000 francs,* there are clergymen of Indian villages whose yearly income does not exceed five or six hundred francs.† The bishop and chapter of Valladolid sent, at different times, to the king as a voluntary contribution, particularly during the last war against France, the sum of 810,000 francs.‡ The lands of the Mexican clergy (*bienes raices*) do not exceed the value of 12 or 15 millions of francs;§ but the clergy possess immense capitals hypothecated on the property of individuals. The whole of these capitals, (*capitales de Capellanias y*

to the Spanish government, they amount to 118,625. M. de La Borde estimates the population of Spain at 11,000,000, and he states the proportion of the clergy to the population as 1 : 69; though $\frac{11,000,000}{147,657}=74.497$, say 74 1-2, and not 69.

But the estimate of 228,000 clergy, and a corresponding proportion of 20 in the thousand, or 1 in 50 to the population, is in every way much beyond the truth. M. de Humboldt having found from M. de La Borde, that the proportion between the clergy and population in Madrid, was 20 : 1,000, has been led to extend the same proportion over all Spain. Yet he afterwards, in the Statistical Analysis, states it as a peculiar merit in M. de La Borde, that he had first proved that the proportion of Spanish clergy to the population was less than that of the French clergy to the population before the revolution, which was 460,078 : 25,000,000=1 : 54.444, say 54 4-10; (and not 1 : 52, as La Borde calculates;) but a clergy of 228,000 in a population of 11,000,000, would be more numerous in proportion than that of France before the revolution. *Trans.*

* 27,085*l.* sterling. *Trans.*

† From 20*l.* to 25*l.* sterling. *Trans.*

‡ 33,752*l.* sterling. *Trans.*

§ *From* 500,040*l.* to 625,050*l.* sterling. *Trans.*

obras pias, fondos totales de Communidades religiosas,) of which we shall give a detail in the sequel, amounts to the sum of 44 millions and a half of double piastres,* or 233,625,000 francs.† Cortez, from the very commencement of the conquest, dreaded the opulence of the clergy in a country where ecclesiastical discipline is difficult to maintain. He says very frankly in a letter to Charles the Fifth, "that he beseeches his majesty to send out to the Indies *religieux* and not *canons*, because the latter display an extravagant luxury, leave great wealth to their natural children, and give great scandal to the newly converted Indians." This advice, dictated by the frankness of an old soldier, was not followed at Madrid. We have transcribed this curious passage from a work published several years ago by a cardinal.‡ It is not for us to accuse the conqueror of New Spain of predilection for the regular clergy, or antipathy towards the canons.

The rumour spread up and down Europe of the immensity of the Mexican wealth has given rise to very exaggerated ideas relative to the abundance of gold and silver employed in New Spain in plate, furniture, kitchen utensils, and harness. A traveller, whose imagination has been heated by stories of keys, locks, and hinges of massy silver, will be very much

* 13,485,453*l.* sterling. *Trans.*

† I have followed the data contained in the *Representacion de los vecinos de Valladolid al Excellentissimo Senor Virey*, (dated 24th October, 1805,) a manuscript memoir of great value. I compute in the course of this work the double piastre at 5 livres 5 sous. Its intrinsic value is 5 livres 8 1-3 sous. We must not confound the *pezo*, which is sometimes called *pezo sencillo* or *commercial piastre*, which is a fictitious money, with the *double piastre* of America, or *te duro*, or *te pezo duro*. The double piastre contains 20 reals of vellon, or 170 *quartos*, or 680 *maravedis*, while the *pezo sencillo*, which is equal to 3 livres 15 sous, contains only 15 reals of vellon, or 510 maravedis.

‡ Archbishop Lorenzana.

surprised on his arrival at Mexico at seeing no more of the precious metals employed for domestic uses there than in Spain, Portugal, and the rest of the south of Europe; and he will be as much astonished at seeing in Mexico, Peru, or at Santa Fe, people of the lowest order barefooted with enormous silver spurs on, or at finding silver cups and plates a little more common there than in France and England. The surprise of the traveller will cease when he reflects that porcelain is very rare in these newly civilized regions; that the nature of the roads in the mountains renders the carriage of it extremely difficult; and that in a country of little commercial activity, it is equally indifferent whether a few hundred piastres be possessed in specie or in plate. Notwithstanding, however, the enormous difference of wealth between Peru and Mexico, considering merely the fortunes of the great proprietors, I am inclined to believe that there is more true comfort at Lima than at Mexico. The inequality of fortunes is much less in the former; and if it is very rare, as we have already observed, to find individuals there who possess a revenue of 50 or 60,000 francs,* we meet, however, with a great number of mulatto artisans and free negroes, who, by their industry alone, procure much more than the necessaries of life. Capitals of 10 and 15,000 piastres† are very common among this class, while the streets of Mexico swarm with from twenty to thirty thousand wretches, (*Saragates, Guachinangos,*) of whom the greatest number pass the night *sub dio*, and stretch themselves out to the sun during the day with nothing but a flannel covering. These dregs of the people bear much analogy to the Lazaroni of Naples. Lazy, careless,

* 2,083*l.* or 2,500*l.* sterling. *Trans.*

† If single or commercial piastres = 1,560*l.* and 2,340*l.* sterling. *Trans.*

and sober like them, the Guachinangos have nothing, however, ferocious in their character, and they never ask alms; for if they work one or two days in a week, they earn as much as will purchase their pulque, or some of the ducks with which the Mexican lakes are covered, which are roasted in their own fat. The fortune of the Saragates seldom exceeds two or three reals, while the lower people of Lima, more addicted to luxury and pleasure, and perhaps also more industrious, frequently spend two or three piastres in one day. One would say that the mixture of the European and the negro everywhere produces a race of men more active and more assiduously industrious than the mixture of the whites with the Mexican Indian.

The kingdom of New Spain is, of all the European colonies under the torrid zone, that in which there are the fewest negroes. We may almost say that there are no slaves. We may go through the whole city of Mexico without seeing a black countenance. The service of no house is carried on with slaves. In this point of view, especially, Mexico presents a singular contrast to the Havannah, Lima, and Caraccas. From exact information procured by those employed in the enumeration of 1793, it appears that in all New Spain there are not six thousand negroes, and not more than nine or ten thousand slaves, of whom the greatest number belong to the ports of Acapulco and Vera Cruz, or the warm regions of the coasts, (*tierras calientes.*) The slaves are four times more numerous in the *capitania general* of Caraccas, which does not contain the sixth part of the population of Mexico. The negroes of Jamaica are to those of New Spain in the proportion of 250 to 1! In the West-India Islands, Peru, and even Caraccas, the progress of agriculture and industry in general depends on the augmentation of negroes. In the island of Cuba, for example, where the annual *exportation* of sugar has risen in twelve

years from 400,000 to 1,000,000 quintals, between 1792 and 1803 nearly 55,000* slaves have been introduced. But in Mexico the increase of colonial prosperity is nowise occasioned by a more active slave trade. It is not above twenty years since Mexican sugar was known in Europe; Vera Cruz at present exports more than 120,000 quintals; and yet the progress of sugar cultivation which has taken place in New Spain since the revolution of St. Domingo has not perceptibly increased the number of slaves. Of the 74,000 negroes annually furnished by Africa to the equinoxial regions of America and Asia, and which are worth in the colonies the sum of 111,000,000 francs,† not above 100 land on the coast of Mexico.

By the laws there can be no Indian slaves in the Spanish colonies: and yet by a singular abuse, two species of wars very different in appearance give rise to a state very much like that of the African slave. The missionary monks of South America make from time to time incursions into the countries possessed by peaceable tribes of Indians, whom they call savages, (*Indios bravos*,) because they have not learned to make the sign of the cross like the equally naked Indians of the missions (*Indios reducidos*.) In these nocturnal incursions, dictated by the most culpable fanaticism, they lay hold of all whom they can surprise, especially children, women, and old men. They separate without pity children from their mothers, lest they should concert together as to the means of escape. The monk who is chief of this expedition distributes the young people among the Indians of his mission who have the most contributed to the

* According to the custom-house reports of the Havannah, of which I possess a copy, the introduction of negroes, from 1799 to 1803 was 34,500, of whom 7 per cent. die annually.

† 4,625,370*l*, sterling. *Trans.*

success of the *Entrados*. On the Orinoco, and on the banks of the Portuguese Rio Negro, these prisoners bear the name of *Poitos;* and they are treated like slaves till they are of an age to marry. The desire of having Poitos and making them work for eight or ten years induces the Indians of the missions to excite the monks to these incursions, which the bishops have generally had the good sense to blame, as the means of attaching odium to religion and its ministers. In Mexico the prisoners taken in the petty warfare, which is carried on almost without interruption on the frontiers of the *provincias internas*, experience a much more unhappy fate than the Poitos. They are generally of the nation of the Mecos or Apaches, and they are dragged to Mexico, where they languish in the dungeons of a correction-house, (*la Cordada.*) Their ferocity is increased by solitude and despair. Transported to Vera Cruz and the island of Cuba, they soon perish, like every savage Indian removed from the high table-land into the lower, and consequently hotter regions. These Mecos prisoners sometimes break from their dungeons, and commit the most atrocious cruelties in the surrounding countries. It is high time that the government interested itself in these unfortunate persons, whose number is small, and their situation so much the easier to be ameliorated.

It appears that at the commencement of the conquest there were a great number of these prisoners of war at Mexico, who were treated as the slaves of the conquerors. I found on this subject a very remarkable passage in the testament of Hernan Cortez,* an

* *Testamento quo otorgò el Excellentissimo Senor Don Hernan Cortez, Conquistador de la Nueva Espa a hecho en Sevilla el* 11 *del mes de Octobre*, 1547. The original of this very curious document, of which I caused a copy to be taken, exists in the archives of the house *del Estado*, (of the Marquis del Valle,) situated in the *Plaza Mayor* of Mexico. I found

historical monument worthy of being preserved from oblivion. This great captain, who, during the course of his victories, especially in his perfidious conduct towards the unfortunate Montezuma the Second, did not display much delicacy of conscience,* began towards the end of his career to entertain scruples as to the legitimacy of the titles by which he possessed immense property in Mexico. He ordered his son to make the most careful inquiries into the tributes levied by the Mexican lords who were proprietors of his marquisate before the arrival of the Spaniards at Vera Cruz; and he even wishes that the value of the tributes exacted in his name above the imposts formerly paid should be restored to the native. Speaking of the slaves in the 39th and 41st articles of his testament, Cortez adds the following memorable words: "As it is doubtful if a christian can conscientiously employ as slaves Indians who have been made prisoners of war, and as this point has never been rightly cleared up till this day, I order my son Don Martin, and those of his descendants who shall possess my property after me, to take every possible information as to the rights which may be legally ex-

also in these archives a memoir drawn up by Cortez, shortly after the siege of Tenochtitlan, containing instructions relative to the making of roads, establishment of inns on the great roads, and other objects of general police.

* Cortez, in his letters dated from la ricca villa de Vera Cruz, describes the city of Tenochtitlan to the Emperor Charles the Fifth as if he were speaking of the wonders of the capital of el Dorado. After transmitting to him all the information he could procure regarding the wealth "of the powerful Lord Montezuma," he assures his sovereign, that living or dead the Mexican king must fall into his hands. "*Certifiquè a Vuestra Alteza que lo habria preso o muerto o subdito a la Real Corona de Vuestra Magestad.*" (Lorenzana, p. 39.) We are to observe that this project was conceived while the Spanish general was yet on the coast, and had had no communication with the ambassadors of Montezuma.

ercised towards prisoners. The natives, who after paying me tribute have been forced to yield personal service, ought to be indemnified, if it shall be decided in the sequel that these personal services ought not to have been demanded." From whom should we expect decisions on such problematical questions as these, except from a pope or a council? We must own that three centuries later, notwithstanding the civilization of a more enlightened age, the rich proprietors in America have less timorous consciences even on death-bed. In our days, it is not the devotees but the philosophers who call in question the justice of slavery! But the small influence which the empire of philosophy has always had induces us to believe that it would have been better for suffering humanity had this sort of scepticism still been preserved among believers.*

However, the slaves, who fortunately are in very small numbers in Mexico, are there, as in all the other Spanish possessions, somewhat more under the protection of the laws than the negroes of the other European colonies. These laws are always interpreted in favour of liberty. The government wishes to see the number of freemen increased. A slave, who by his industry has procured a little money, may compel his master to give him his liberty on paying the moderate sum of 1,500 or 2,000 livres.† Liberty cannot be refused to a negro on the pretext that he cost the triple of the sum, or that he possesses a particular talent for some lucrative employment. A

* Had M. de Humboldt been acquainted with the history of the endeavours in this country to abolish the slave trade, he would have found that these endeavours were principally made by men whom he would call devotees, who acted under the influence of religious motives. The sect of quakers in particular, and this ought to cover a multitude of their absurdities, were always staunch enemies to slavery. *Trans.*

† 62*l.* or 83*l.* sterling. *Trans.*

slave who has been cruelly used acquires on that account his freedom by the law, if the judge do justice to the cause of the oppressed; but it may be easily conceived that this beneficent law must be frequently eluded. I saw, however, even in Mexico, in the month of July, 1803, an example of two negroes to whom the magistrate, who exercised the functions of *alcalde de corte*, gave their liberty, because their mistress, a lady from the islands, had wounded them all over the body with scissors, pins, and knives. In the course of this shocking process, the lady was accused of having, with a key, knocked out the teeth of the slaves when they complained of a fluxion in the gums, which prevented them from working. The Roman matrons were not more ingenious in their punishments. Barbarity is the same in all ages, when men can indulge their passions without restraint, and when governments tolerate an order of things contrary to the laws of nature, and, consequently, to the welfare of society.

We have enumerated the different races of men who, at present, constitute the population of New Spain. On glancing our eyes over the physical views or sections which we have drawn up of this country, we see that the greater part of a nation of six millions of inhabitants may be considered as Highlanders. On the table-land of Anahuac, whose elevation surpasses at least twice that of the clouds which in summer are suspended over our heads, are assembled together copper-coloured men from the north-west part of North America, Europeans, and a few negroes from the coasts of Bonny, Calabar, and Melimbo. When we consider that what we now call Spaniards is a mixture of Alani and other Tartar hordes with the Visigoths and ancient inhabitants of Iberia; when we also consider the striking analogy between the most part of the European languages, the Sanscrit, and the Persic; and, in short, when we

reflect on the Asiatic origin of the pastoral tribes who have been pouring into Mexico since the seventh century, we are almost tempted to believe, that from one and the same centre, though by roads diametrically opposite, have issued part of those nations, who, wandering about for a long time, and after making, as it were, the tour of the globe, meet once more on the ridge of the Mexican Cordilleras.

To complete the table of the elements of which the Mexican population is composed, it remains for us to point out rapidly the differences of cast which spring from the mixture of the pure races with one another. These casts constitute a mass almost as considerable as the Mexican Indians. We may estimate the total of the individuals of mixed blood at nearly 2,400,000. From a refinement of vanity, the inhabitants of the colonies have enriched their language with terms for the finest shades of the colours which result from the degeneration of the primitive colour. It may be so much the more useful to explain these denominations,* as they have been confounded by many travellers, and as this confusion frequently causes no small embarrassment to those who read Spanish works on the American possessions.

The son of a white (Creole or European) and a native of copper-colour, is called *Mestizo*. His colour is almost a pure white; and his skin is of a particular transparency. The small beard and small hands and feet, and a certain obliquity of the eyes, are more frequent indications of the mixture of Indian blood than the nature of the hair. If a *Mestiza* marry a white man, the second generation differs hardly in any thing from the European race. As very few negroes have been introduced into New

* *Sobre el Clima de Lima, por el Doctor Unanue*, p. xlviii. a work printed in Peru, in 1806.

Spain, the Mestizoes probably compose 7-8 of the whole casts. They are generally accounted of a much more mild character than the *mulattoes*, descended from whites and negresses, who are distinguished for the violence of their passions and a singular volubility of tongue. The descendants of negroes and Indian women bear at Mexico, Lima, and even at the Havannah, the strange name of *Chino*, Chinese. On the coast of Caraccas, and, as appears from the laws, even in New Spain, they are called *zambos*. This last denomination is now principally limited to the descendants of a negro and a female mulatto, or a negro and a Chinese female. From these common zamboes, they distinguish the *zamboes prietos*, who descend from a negro and a female zamba. From the mixture of a white man with a mulatto comes the cast of *quarterons*. When a female quarteron marries a European or Creole, her son bears the name of *quinteron*. A new alliance with a white banishes to such a degree the remains of colour, that the children of a white and female quinteron are white also. The casts of Indian or African blood preserve the odour peculiar to the cutaneous transpiration of those two primitive races. The Peruvian Indians, who in the middle of the night distinguish the different races by their quick sense of smell, have formed three words to express the odour of the European, the Indian American, and the negro: they call the first *pezuna*, the second *posco*,* and the third *grajo*. Moreover, the mixtures, in which the colour of the children becomes deeper than that of their mother, are called *salta-atras*, or back-leaps.

In a country governed by whites, the families reputed to have the least mixture of negro or mulatto blood are also naturally the most honoured. In Spain it is almost a title of nobility to descend neither from

* Old word of the Oquichua language.

Jews nor Moors. In America, the greater or less degree of whiteness of skin decides the rank which man occupies in society. A white who rides barefooted on horseback thinks he belongs to the nobility of the country. Colour establishes even a certain equality among men, who, as is universally the case where civilization is either little advanced or in a retrograde state, take a particular pleasure in dwelling on the prerogatives of race and origin. When a common man disputes with one of the titled lords of the country, he is frequently heard to say, "Do you think me not so white as yourself?" This may serve to characterize the state and source of the actual aristocracy. It becomes, consequently, a very interesting business for the public vanity to estimate accurately the fractions of European blood which belong to the different casts. According to the principles sanctioned by usage, we have adopted the following proportions:

Casts.	Mixture of blood.	
Quarterons . . .	1-4 negro	3-4 white
Quinterons . . .	1-8 negro	7-8 white
Zambo . . .	3-4 negro	1-4 white
Zambo prieto . .	7-8 negro	1-8 white.

It often happens that families suspected of being of mixed blood demand from the high court of justice (*Audiencia*) to have it declared that they belong to the whites. These declarations are not always corroborated by the judgment of the senses. We see very swarthy mulattoes who have had the address to get themselves *whitened;* (this is the vulgar expression.) When the colour of the skin is too repugnant to the judgment demanded, the petitioner is contented with an expression somewhat problematical. The sentence then simply bears "that such

or such individuals may consider themselves as whites, (*que se tengan por blancos.*")

It would be interesting were we enabled to discuss thoroughly the influence of the diversity of casts in the proportion of the sexes to one another. I saw, from the enumeration in 1793, that in the city of Puebla and at Valladolid there were among the Indians more men than women, while among the Spaniards or the white race there were more women than men. The intendancies of Guanaxuato and Oaxaca exhibit in all the casts the same excess of men.* I never could procure sufficient materials to resolve the problem of the diversity of sexes according to the difference of races, or according to the heat of the climate or elevation of the regions which our species inhabit: we shall here, therefore, merely content ourselves with general results.

In France it has been found by a partial enumeration made with the greatest care, that in 991,829 souls, the living women are to the men in the proportion of nine to eight. M. Peuchet† appears to adopt the proportion of 34 : 33. It is certain that in France there are more women than men, and, what is very remarkable, that there are more males born in the country and in the south than in the towns and

* This hardly makes in favour of John Rheinhold Forster's theory, embraced with so much ardour by the far-famed Mary Wollstonecroft in her Rights of Women, that the sex of the offspring is determined by the side on which the preponderance of ardour lies in the sexual intercourse. Hence, says she, "there are more females than males in the east; for the females being deprived of their just share in that intercourse, have consequently a more than ordinary share of ardour. Yet here we see that these beardless Indians, who are cool enough in all conscience, and to whom their women prefer any thing that comes in their way, black or white, beget more males than females." *Trans.*

† *Statistique elementaire de la France*, p. 242.

departments comprehended between the 47th and 52d degree of latitude.

But in New Spain these arithmetical calculations give a result totally different. The males are in general more numerous there than the females, as is proved by the following table, drawn up by me from eight provinces, or a population of 1,352,000 inhabitants.

Names of Intendancies and Governments.	Diversity of races.	Males.	Females.	Proportion of males to females.
Guanaxuato	Spaniards or whites	53,983	49,316	100 : 91
	Indians or indigenous	89,753	85,429	100 : 95
	Mixed casts	59,659	59,604	100 : 99
Valladolid de Mechoacan	Spaniards	40,399	39,081	100 : 97
	Indians	61,352	58,016	100 : 94
	Mixed casts	44,704	43,704	100 : 98
Oaxaca	Spaniards	12,923	12,882	100 : 99
	Indians	182,342	180,738	100 : 99
	Mixed casts	11,163	10,566	100 : 95
Durango	In these five provinces the total of all the races is merely given.	60,727	59,586	100 : 98
Sonora*		20,473	17,832	100 : 87
Cinaloa		27,772	27,290	100 : 98
Nuevo Mexico		15,915	14,910	100 : 94
California		6,770	5,946	100 : 87
		687,935	664,900	mean as 100 to 95
		1,352,835		

* It might be supposed that the excess of males in the north of Mexico is partly owing to the existence of the military posts called *presidios*, in which there are no women. But we shall afterwards see, that these presidios in the whole do not contain more than three thousand men.

greater than what it was found. But it appears that in other countries the male deaths are more frequent than the female deaths. At Yguala and Colimaya, the former were to the latter, for ten years, as 1204 : 1191 and 1330 : 1272. M. de Pomelles has already observed, that in France even, the difference of the sexes is much more sensible in the births than in the deaths; there are one-seventeenth more males than females born, and the peaceful state of the country peasants gives only one-nineteenth more male than female deaths. From the whole of these data we may conclude, that in Europe as well as the equinoxial regions, who have enjoyed a long state of tranquillity, we should find an excess of males, if the sea, the wars, and dangerous employments peculiar to our sex, did not tend incessantly to diminish their number.

The population of the great cities is by no means stable, and does not remain in a state of equilibrium with respect to the different sexes. The country women come into the cities to serve in houses who want slaves; and a great number of men leave them to travel through the country as muleteers, (*arrieros*,) or to fix their abode in places where there are considerable mines. Whatever be the cause of this disproportion of sexes in the cities, it is no less certain that such a disproportion exists. The following table, which includes only three cities, exhibits a striking contrast to the table which we gave of the general population of eight Mexican provinces:

Names of cities.	Diversity of races.	Males.	Females.	Proportion of males to females.
Mexico	Europeans*	2,118	217	100 : 10
	Spaniards or Creole whites	21,338	29,033	100 : 136
	Indians or indigenous	11,232	14,371	100 : 128
	Mulattoes	2,958	4,136	100 : 140
	Other casts or mixed races	7,832	11,525	100 : 147
Queretaro	Spaniards	2,207	2,929	100 : 133
	Indians	5,394	6,190	100 : 115
	Mixed casts	4,639	5,490	100 : 118
Valladolid	Spaniards	2,207	2,929	100 : 133
	Mulattoes	1,445	1,924	100 : 133
	Indians	2,419	2,276	100 : 93
		63,789	81,020	Medium 100 to 127.
		144,809		

* This apparent disproportion proceeds from the small number of Spanish women who quit Europe for Mexico.

In the United States of North America the enumerations, which include the whole population, indicate, as in Europe* and Mexico, an excess of males in life. This excess is very unequal in a country where the emigraiton of whites, the introduction of many male slaves, and maritime commerce, tend incessantly to disturb the order prescribed by nature. In the states of Vermont,† Kentucky, and South Carolina, there are almost one-tenth more males than females, while in Pennsylvania and the state of New-York this disproportion does not amount to one-eighteenth.

When the kingdom of New Spain shall enjoy an administration favourable to knowledge, political arithmetic will there furnish data of infinite importance both for statistics in general, and for the physical history of man in particular. How many problems are to resolve in a mountainous country, which exhibits under the same latitude the greatest variety of climates, inhabitants of three or four primitive races, and the mixture of these races in all the combinations imaginable! How many researches to make regarding the age of puberty, the fecundity of the species, the difference of the sexes, and the longevity which is greater or less according to the elevation and temperature of the places, according to the variety of races, according to the epoch at which the colonists were transplanted into such or such a region, and, in short, according to the difference of food in provinces where the banana, the jatropha, rice, maize, wheat, and potatoes, grow together in a narrow space.

A traveller cannot give himself up to researches which require much time, the intervention of the supreme authority, and the concurrence of a great

* Yet he has just stated, that in the French empire the females in life are to the males as 103 to 100! *Trans.*

† Samuel Blodget, p. 75.

number of individuals interested in accomplishing the same end. It is sufficient here to have pointed out what remains to be done, when the government shall be disposed to profit by the happy position in which nature has placed this extraordinary country.

The operations of 1793, respecting the population of the capital, offer results which are deserving of a place at the end of this chapter. The individuals in this part of the enumeration, below and above the age of fifty, were distinguished according to the difference of cast; and it was found that this epoqua was passed:

By 4,128 white Creoles in a total population of	50,371	Individuals of the same race.
By 539 Mulattoes - -	7,094	
By 1,789 Indians - -	25,603	
By 1,278 of mixed blood -	19,357	

So that there have past the age of 50:

In 100 white Creoles (Spaniards)	8
Indians - -	6 4/5
Mulattoes -	7
Individuals of other mixed casts	6

These calculations, while they confirm the admirable uniformity which reigns in all the laws of nature, seem to indicate that longevity is somewhat greater in the races which are best fed, and in which the epoqua of puberty is later. Of 2,335 Europeans who were living in Mexico in 1793, not fewer than 442 had attained the age of fifty, which by no means proves that the Americans have three times less probability of attaining an advanced age than the Europeans; for the Europeans seldom remove to America till they have come to a mature age.

After examining the physical and moral state of the different casts of which the Mexican population is composed, the reader will no doubt desire to have a discussion of what is the influence of this mixture of races on the general well being of society? and

BOOK III.

PARTICULAR STATISTICAL ACCOUNT OF THE INTENDANCIES OF WHICH THE KINGDOM OF NEW SPAIN IS COMPOSED. THEIR TERRITORIAL EXTENT AND POPULATION.

CHAPTER VIII.

Of the political division of the Mexican territory, and the proportion of the population of the intendancies to their territorial extent. Principal cities.

Before giving the table which contains a particular statistical account of the intendancies of New Spain, we shall discuss the principles on which the new territorial divisions are founded. These divisions are entirely unknown to the most modern geographers; and we here repeat what we have already stated in the introduction to this work, that our general map of New Spain is the only one which contains the limits of the intendancies established since 1776.

Mr. Pinkerton, in the second edition of his Modern Geography,* has endeavoured to give a minute

* It is this moment announced (Bibliothèque Americaine, 1808, No. 9.) that M. Pinkerton boasts of having availed himself of my manuscripts for his work on Mexico. I communicated, with the frankness natural to me, several manu-

description of the Spanish possessions in North America; and he has contrived to mix several exact notions derived from the *Viajero Universal*, with the most vague data furnished by the dictionary of M. Alcedo. This author, who believes himself to possess a singular knowledge of the true territorial divisions of New Spain, considers the provinces of Sonora, Cinaloa, and la Pimeria, as parts of New Biscay. He divides what he calls the dominion (*domaine*) of Mexico into the districts of Nueva Gallicia, Panuco, Zacatula, &c. &c. According to this principle we should say, that the three great divisions of Europe are Spain, Languedoc, Catalonia, and the territories of Cadiz and Bordeaux.

Before the introduction of the new administration by Count Don Jose de Galvez, minister of the Indies, New Spain contained, 1. El Reyno de Mexico; 2. El Reyno de Nueva Gallicia; 3. El Nuevo Reyno de Leon; 4. La Colonia de Nuevo Santander; 5. La Provincia de Texas; 6. La Provincia de Cohahuila; 7. La Provincia de Nueva Biscaya; 8. La Provincia de la Sonora; 9. La Provincia de Nuevo Mexico; and,

script notes to M. Bourgoing, M. Alexander Laborde, and several other *savans* of equal respectability. I never communicated any thing to M. Pinkerton; and the manner in which he treated me in his Geography, before my return to Europe, was not calculated to produce an intimacy between us. A compiler as inaccurate as he is arrogant, M. Pinkerton, in the style which is peculiar to him, finds every thing which is repugnant to the ideas formed by him in his closet "ridiculous, disgusting, and absurd." Not knowing that the map of La Cruz is drawn up from that of Father Caulin, he will allow no other course to the rivers but what he finds indicated by the former. He pushes his scepticism so far, that if we would believe him, M. Depons, the author of the *Voyage à la Terre-Ferme*, does not even know the name of the country in which he lived for four years! The notes of the new edition of M. Pinkerton's Geography especially contribute to diffuse the most erroneous ideas in physics and descriptive natural history.

10. Ambas Californias, or las provincias de la vieja y Nueva California. These old divisions are still very frequently used in the country. The limits which separate la Nueva Gallicia from el Reyno de Mexico, to which a part of the old kingdom of Mechoacan belongs, are also the line of demarcation between the jurisdiction of the two audiences of Mexico and Guadalaxara. This line, which I was not able to trace on my general map, does not exactly follow the contours of the new intendancies. It begins on the coast of the gulf of Mexico, ten leagues to the north of the Rio de Panuco and the city of Altamira near Bara Ciega, and runs through the intendancy of S. Luis Potosi to the mines of Potosi and Bernalejo; from thence passing along the southern extremity of the intendancy of Zacatecas, and the western limits of the intendancy of Guanaxuato, it traverses the intendancy of Guadalaxara between Zapotlan and Sayula, between Ayotitlan and the Ciudad de la Purificacion, to Guatlan, one of the ports of the South Sea. All north of this line belongs to the audiencia of Guadalaxara; and all south of it to the audiencia of Mexico.

In its present state New Spain is divided into twelve intendancies, to which we must add three other districts, very remote from the capital, which have preserved the simple denomination of provinces. These fifteen divisions are,

I. UNDER THE TEMPERATE ZONE, 82,000 leagues, with 677,000 souls, or eight inhabitants to the square league.

A. REGION OF THE NORTH, an interior region.

1. *Provincia de Nuevo Mexico*, along the Rio del Norte to the north of the parallel of 31°.
2. *Intendencia de Nueva Biscaya*, to the southwest of the Rio del Norte, on the central table-land, which declines rapidly from Durango towards Chihuahua.

B. REGION OF THE NORTH-WEST, in the vicinity of the Great Ocean.

3. *Provincia de la Nueva California*, or north-west coast of North America possessed by the Spaniards.

4. *Provincia de la Antigua California.* Its southern extremity enters the torrid zone.

5. *Intendencia de la Sonora.* The most southern parts of Cinaloa, in which the celebrated mines of Copala and Rosario are situated, also passes the tropic of Cancer.

C. REGION OF THE NORTH-EAST, adjoining the gulf of Mexico.

6. *Intendencia de San Luis Potosi.* It comprehends the provinces of Texas, la Colonia de Nuevo Santander and Cohahuila, El Nuevo Reyno de Leon, and the districts of Charcas, Altamira, Catorce, and Ramos. These last districts compose the intendancy of San Luis, properly so called. The southern part, which extends to the south of the Barra de Santander and the Real de Catorce, belongs to the torrid zone.

II. UNDER THE TORRID ZONE, 36,500 square leagues, with 5,160,000 souls, or 141 inhabitants to the square league.

D. CENTRAL REGION.

7. *Intendencia de Zacatecas*, excepting the part which extends to the north of the mines of Fresnillo.

8. *Intendencia de Guadalaxara.*

9. *Intendencia de Guanaxuato.*

10. *Intendencia de Valladolid.*

11. *Intendencia de Mexico.*

12. *Intendencia de la Puebla.*

13. *Intendencia de Vera Cruz.*

small portion of the intendancy of San Luis Potosi,* the *Reyno de Mexico*, properly so called. This kingdom consequently contained more than 27,000 square leagues, and nearly four millions and a half of inhabitants.

Another division of New Spain, equally ancient and less vague, is that which distinguishes *New Spain, properly so called*, from the *provincias internas*. To the latter belongs all to the north and north-west of the kingdom of Nueva Gallicia, with the exception of the two Californias; consequently, 1. The small kingdom of Leon; 2. The colony of New Santander; 3. Texas; 4. New Biscay; 5. Sonora; 6. Cohahuila; and, 7. New Mexico. The *provincias internas del Vireynato*, which contain 7,814 square leagues, are distinguished from the *provincias internas de la Comandancia*, (of Chihuahua,) erected into a *capitania general* in 1779, which contain 59,375 square leagues. Of the twelve new intendancies, three are situated in the *provincias internas*, Durango, Sonora, and San Luis Potosi. We must not, however, forget that the intendant of San Luis is only under the direct authority of the viceroy for Leon, Santander, and the districts near his residence, those of Charcas, Catorce, and Altamira. The governments of Cohahuila and Texas make also a part of the intendancy of San Luis Potosi, but they belong directly to the *comandancia general* de Chihuahua. The following tables will throw some light on these very complicated territorial divisions. Let us divide all New Spain into

A. *Provincias sujetas al Virey de Nueva Espana*; 59,103 square leagues, with 547,790† souls: the ten intendancies of Mexico, Puebla, Vera

* The most southern part through which the river of Panuco runs.

† This number ought to be 5,479,095. *Trans.*

Cruz, Oaxaca, Merida, Valladolid, Guadalaxara, Zacatecas, Guanaxuato, and San Luis Potosi, (without including Cohahuila and Texas.)
The two Californias.

B. *Provincias sujetas al comandante general de provincias internas*, 59,375 square leagues, with 359,200 inhabitants.
The two intendancies of Durango and Sonora;
The province of Nuevo Mexico;
Cohahuila and Texas.

The whole of New Spain, 118,478 square leagues, with 5,837,100 inhabitants.

These tables exhibit the surface of the provinces calculated in square leagues of 25 to the degree, according to the general map accompanying this work. The first calculations were made at Mexico in the end of 1803, by M Oteyza and myself. My geographical labours having since that period attained to greater perfection, M. Oltmanns was so good as to recalculate the whole territorial surfaces. He executed this operation with the precision which characterizes whatever he undertakes, having formed squares of which the sides did not contain more than three minutes.

The population indicated in my tables is what may be supposed to have existed in 1803. I have explained in the 4th chapter, the principles on which the changes were made in the numbers obtained by the enumeration of 1793. I am aware that modern geographers admit only from two to three millions of inhabitants for Mexico. In all times the population of Asia has been exaggerated, and that of the Spanish possessions in America lowered. We forget that with a fine climate and fertile soil, population makes rapid advances even in countries the worst administered; and we also forget that men scattered over an immense territory suf-

fer less from the imperfections of the social state than when the population is very concentrated.

We are uncertain as to the limits which ought to be assigned to New Spain to the north and east. It is not enough that a country has been run over by a missionary monk, or that a coast has been seen by a vessel of war, to consider it as belonging to the Spanish colonies of America. Cardinal Lorenzana printed at Mexico, even in 1770, that New Spain, through the bishopric of Durango, bordered perhaps on Tartary and Greenland!* We are now too well instructed in geography to yield ourselves up to such vague suppositions. A viceroy of Mexico caused the American colonies of the Russians on the peninsula of Alaska, to be visited from San Blas. The attention of the Mexican government was for a long time turned to the north-west coast, especially since the establishment at Nootka, which the court of Madrid was compelled to abandon to avoid a war with England. The inhabitants of the United States carry their civilization towards the Missouri. They gradually approach the coast of the Great Ocean, to which the fur trade invites them. The period approaches when, through the rapid progress of human cultivation, the boundaries of New Spain will join those of the Russian empire, and the great confederation of American republics. At present, however, the Mexican government extends no farther along the western coast than the mission of St. Francis, to the south of Cape Mendocin, and the village of Taos in New Mexico. The boundaries of the intendancy of San Luis Potosi on the east, towards the state of Louisiana, are not very well determined; the congress of Washington endeavour to confine them to the right

* "*Y aun se ignora si la Nueva Espana por lo mas remoto de la diocesis de Durango confina con la Tartaria y Groelandia, por las Californias con la Tartaria, y por el Nuevo Mexico con la Groelandia.*" Lorenzana, p. 38.

bank of the Rio Brave del Norte, while the Span
comprehend under the denomination of the pro
of Texas, the savannas which extend to the
Mexicano or Mermentas, to the east of the Ri
bina.

The following table exhibits the surface and
pulation of the greatest political associations of
rope and Asia. It will furnish curious compari
with the present state of Mexico.

Great political associations in 1808.	Square leagues of 25 to the degree.	Total population.	Inhabitants to the square league.
Russian empire	942,452	40,000,000	42
1. European part	215,809	36,400,000	169
2. Asiatic part	726,644	3,597,000	5
The single government of Irkutzk	350,000	680,600	2
The single government of Tobolsk	200,000	72,547	1
All Europe	476,111	182,599,000	383
The United States of North America, viz.			
1. With Louisiana	260,340	6,800,000	22
2. Without Louisiana*	156,240	6,715,000	43
3. Without Louisiana and the Indian territory (in Georgia and Western Waters)	78,120	6,655,000	85
Hindostan on this side (*en-deça*) the Ganges†	162,827		

* The calculations regarding America proceed on an erroneous estimation of the square mile. The territory without Louisiana amounts only to 117,478, and not 156,240 square leagues. See this explained in note, p. 211. by the translator. *Trans.*

† According to Arrowsmith's beautiful map of India, 1804. (Journal Astronomique de MM. Zach et Lindenau, 1807, p. 361.) The rest of the data from the classical work of M. Hassel, Statistical View of the States of Europe, No. I. (1805,) in German.

Great political associations in 1808.	Square leagues of 25 to the degree.	Total population.	Inhabitants to the square league.
English territory, of which the East-India company possesses the sovereignty	48,299	23,806,000	493
Allies and tributaries of the English company	32,647	16,900,000	518
Turkish empire in Europe, Asia, and Africa	136,110	25,330,000	186
Austrian monarchy	33,258	25,588,000	769
France, according to M. Peuchet	32,000	35,000,000	1,094
Spain, according to M. Laborde	25,147	10,409,000	413
New Spain,			
1. With the provincias internas	118,378	5,837,100	49
2. Without the provincias internas	51,289	5,413,900	105

We see from this table, which may suggest very curious considerations as to the disproportion of European cultivation, that New Spain is almost four times larger than the French empire, with a population which till this day is seven times smaller. The points of analogy in a comparison of the United States* with Mexico are very striking, especially

* The extent of territory of the United States is very difficult to estimate in square leagues, especially since the acquisition of Louisiana, the limits of which may be said to be very uncertain towards the west and north-west. According to M. Hutchins, the old geographer of the congress, and the author of the beautiful map of the countries situated beyond the Ohio, the United States contained in 1795 a surface of 640 millions of acres, or (discounting the lakes) 589 millions. Now 640 acres make a square mile; consequently (reducing in the proportion of 144 : 25) the 589 millions of acres are equivalent to 159,000 square leagues, of 25 to the degree. I have followed in the estimation of the territory in the preceding table the manuscript notes with which I was furnished by a respectable statesman, M. Gallatin, the American treasurer at Washington. According to these notes, the United States, without Louisiana, contain 900,000 *square miles*, or 156,240 square leagues. This number is less by one-ninth than what is generally adopted by the American geographers; but this difference proceeds from the more exact calculations of the surface of the lakes, and the more eastern position of the Mississippi, determined by the observations of M. Ellicot. M. Gallatin believes that the error of his estimation does not exceed 50,000 *square miles*. The half of these 156,240 square leagues belongs to the Indians, and can only be considered in the light of a country possessed by allies. I am of opinion that if we only include the regions in which the whites have already made establishments, and exclude those which are either desert or inhabited by Indians, the territory of the United States in place of 260,340 ought not to be estimated above 100 or 120,000 square leagues. *Author.*

The author is correct enough in the number of acres which he assigns to the square mile, but he errs in converting the square miles into square leagues. The proportion by which he reduces the square miles into leagues is 144 : 25, which is equal to 5.76 : 1. This proportion corresponds exactly to

if we consider Louisiana and the western territory as the *provincias internas* of the great confederation of American republics.

I have described the state of the *provincias internas* as it was when I left Mexico. A considerable change has since taken place in the military government of these vast provinces, of which the surface almost doubles that of the French empire. In 1807 two *comandantes generales*, brigadier generals, (*brigadiers*) Don Nemesio Salcedo and Don Pedro Grimarest, governed these northern provinces. The following is the present division of the *Gobierno militar*, which is now no longer in the hands of the governor of Chihuahua alone:

PROVINCIAS INTERNAS DEL REYNO DEL NUEVA ESPANA.

A. *Provincias internas occidentales.*
1. Sonora.
2. Durango o Nueva Biscaya.
3. Nuevo Mexico.
4. Californias.

B. *Provincias internas orientales.*
1. Cohahuila.
2. Texas.
3. Colonia del Nuevo Santander.
4. Nuevo Reyno de Leon.

The new *comandantes generales* of the internal provinces, as well as the old, are considered as at the

geographical miles of 60 to the degree. But the English square mile of 640 acres is not a square geographical mile, but a mile of 69.2 to the degree. Hence the proportion to the square league is not 5.76 : 1, but 7.666 : 1. The territory of the United States therefore does not amount to 156,240 but to 117,478 square leagues. *Trans.*

head of the administration of finances in the two intendancies of Sonora and Durango, in the province of Nuevo Mexico, and in that part of the intendancy of San Luis Potosi which comprehends Texas and Cohahuila. As to the small kingdom of Leon and New Santander, they are only subject to the commandant in a military point of view.

STATISTICAL ANALYSIS OF THE KINGDOM OF NEW SPAIN.

TERRITORIAL DIVISIONS.	Surface in square leagues of 25 to the degree.	Population reduced to the epoqua of 1803.	No. of inhabitants to the squ league.
New Spain, (extent of the whole viceroyalty without including the kingdom of Guatimala.)	118,478	5,837,100	49
A. Provincias internas.	67,189	423,200	6
a. Immediately subject to the viccroy, (provincias internas Vereynato)	7,814	64,000	8
1. Nuevo Reyno de Leon	2,621	29,000	10
2. Nuevo Santander	5,193	38,000	7
b. Subject to the governor of Chihuahua, (provincias internas de la comandancia general)	59,375	359,200	6
1. Intendencia de la Nueva Biscaya o Durango	16,873	159,700	10
2. Intendencia de la Sonora	19,143	121,400	6
3. Cohahuila	6,702	16,900	2
4. Texas	10,948	21,000	2
5. Nuevo Mexico	5,709	40,200	7

TERRITORIAL DIVISIONS.	Surface in square leagues of 25 to the degree.	Population reduced to the epoqua of 1803.	No. of inhabitants to the squ. league.
New Spain, (extent of the whole viceroyalty without including the kingdom of Guatimala.)	118,478	5,837,100	49
B. New Spain, properly so called, immediately subject to the viceroy, comprehending los Reynos de Mexico, Mechoacan y Nueva Gallicia, and the two Californias	51,289	5,413,900	105
1. Intendencia de Mexico	5,927	1,511,900	255
2. Intendencia de Puebla	2,696	813,300	201
3. Intendencia de Vera Cruz	4,141	156,000	38
4. Intendencia de Oaxaca	4,447	534,800	120
5. Intendencia de Merida, or Yucatan	5,977	465,800	81
6. Intendencia de Valladolid	3,446	476,400	273
7. Intendencia de Guadalaxara	9,612	630,500	66
8. Intendencia de Zacatecas	2,355	153,300	65
9. Intendencia de Guanaxuato	911	517,300	568
10. Intendencia de San Luis Potosi, (without including New Santander, Texas, Cohahuila, and the kingdom of Leon)	2,357	230,000	98
11. Old California, (Antigua California)	7,295	9,000	1
12. New California, (Nueva California)	2,125	15,600	7

This statistical table proves the imperfection of the territorial division. It appears that in confiding to intendants the administration of police and finances, the object was to divide the Mexican soil on principles analogous to those followed by the French government on the division of the kingdom into generalities. In New Spain every intendancy comprehends several *sub-delegations*. In the same manner the generalities in France were governed by sub-delegates, who exercised their functions under the orders of the intendant. But in the formation of the Mexican intendancies, little regard has been paid to the extent of territory or the greater or less degree of concentration of the population. This new division indeed took place at a time when the ministers of the colonies, the counsel of the Indies, and the viceroys, were unfurnished with the necessary materials for so important an undertaking. How is it possible to possess the detail of the administration of a country of which there has never been any map, and regarding which the most simple calculations of political arithmetic have never been attempted?

Comparing the extent of surface of the Mexican intendancies, we find several of them ten, twenty, even thirty times larger than others. The intendancy of San Luis Potosi, for example, is more extensive than all European Spain, while the intendancy of Guanaxuato does not exceed in size two or three of the departments of France. The following is an exact table of the extraordinary disproportion among the several Mexican intendancies in their territorial extent; we have arranged them in the order of their extent:

Intendancy of San Luis Potosi, 27,821 square leagues.
of Sonora, 19,143
of Durango, 16,873
of Guadalaxara, 9,612

SELECTIONS

RELATIVE TO

MEXICO.

SELECTIONS

FROM

THE WORKS OF THE BARON DE HUMBOLDT,

RELATING TO THE

CLIMATE, INHABITANTS, PRODUCTIONS,

AND MINES

OF

MEXICO.

WITH NOTES

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LONDON:

PRINTED FOR

LONGMAN, HURST, REES, ORME, BROWN, AND GREEN,

PATERNOSTER-ROW.

1824.

PRINTED BY RICHARD TAYLOR,
SHOE-LANE, LONDON.

INTRODUCTION.

THE object of this work is to present in a condensed form some of the information which is displayed at large in two celebrated works * of M. le Baron de Humboldt. This peculiarly gifted traveller, after traversing countries whose future importance to Europe his discriminating foresight enabled him to predict, gave to the world descriptions of these vast territories, which, while they astonish us by the extent of research, and the varied science they display, are rendered even more valuable by the accurate truth and the candid and manly spirit which pervade them. To those who may now for the first time be

* Political Essay on the Kingdom of Mexico or New Spain; and Geognostical Essay on the Superposition of Rocks.

inquiring into Mexican affairs,—whether for the purpose of engaging their money in any of the enterprises for working the mines of that country, or with the more interesting view of seeking in it a place of residence where their skill and experience may become useful in the great plans which are meditated, and may, at the same time, be made subservient to their own emolument and advancement,—it will be most satisfactory to know that the details which are here laid before them, come from a person whose authority has never been questioned, and whose relations are daily confirmed by many who have since visited the country.

I received permission to submit to the Baron de Humboldt some questions relative to the mines, to which he has had the kindness to return answers the most explicit, and evincing the most profound knowledge of the subject. In the earlier part of his life he had the direction of some important mines in Germany: it will therefore be the more satisfactory to those who, like myself, are especially interested in this part of the inquiry,

to know that the information contained in this volume comes from one on whose judgement the most entire reliance may be placed. I must also add, that these Selections from his works have been made with his knowledge and approbation. I am conscious that it is a liberty I ought not to have taken but from the consideration that the abridgement may now be useful to numbers who could not have availed themselves of the works at large. Valuable as M. de Humboldt's writings are, he has never made them a source of profit to himself, and it may truly be said that public utility is with him the leading object. Actuated by this disinterested feeling, he has constantly refused the most advantageous offers to engage himself in any concerns connected with Mexico, that his mind might remain unbiassed by any consideration of personal interest. I have said thus much, that those who are inclined to attach weight to any statements which I may lay before them, may know the respectability of my authority for many things which wear so flattering an aspect, as to excite a suspicion that they

I was led to do by the desire of comparing the lodes or veins in that country with those which had come under my own observation.

I was then struck with their size or width, with the great productiveness of particular parts, with the similarity of many circumstances with those which miners every where think favourable symptoms, and above all with the greatness of the profits under a system of management of the worst kind. I observed that little or no machinery was employed, and that what there was, seemed to be of the rudest description, that no attempt was made to abridge labour, or to save expense, and that under the old government, obstacles to improvement of the most formidable kind existed. Attempts were indeed sometimes made: but when it is considered that all these were likely to interfere with the profit of Viceroys, or provincial Governors, who, under the court of Spain, enjoyed the privilege of making the people pay at the highest rate for articles of the greatest necessity, it is not surprising that these attempts were stifled and rendered abortive. With the

richest mines in the world, with a splendid college for instructing miners, and with a code of laws which pretended to encourage them, Mexico made no advances in the science of working its mineral treasures; while England, with only metals of inferior value, without any public institution for instruction of this sort, and even without books upon the subject, has within a few years raised the art of mining to a perfection heretofore unknown, and has carried it on in spite of difficulties not to be met with elsewhere.

I long ago formed the opinion which I now entertain, that if the skill and experience in mining which we possess, and the use of our engines, could ever be applied to the mines of Mexico, the result would be that of extraordinary profit.

At that time the Old Government still held its sway over this interesting country: no hope, therefore, existed in my mind of ever seeing the attempt made; in later years the country has been struggling with its former masters, and it now seems likely that, having emancipated itself from their yoke, it will con-

solidate a government more adapted to the wants and interests of the people;—how far it may succeed, and with what measure of wisdom and moderation, I do not pretend to foresee. A failure in produce, similar to that experienced in the mines of Cornwall 60 or 80 years ago, before the application of the steam-engine, had already given a considerable check to the prosperity of the mines; and in the year 1810, at the commencement of the civil commotions in Mexico, they experienced a fatal blow by the interruption to industry produced by internal war. The proprietors no longer received their usual revenues, and the mines becoming full of water, the whole country was impoverished, and at the return of better times the necessary capital for renewing the works did not exist. This is the cause of the application to other countries on the part of the Mexican proprietor, and the reason of his willingness to alienate a part of his interest in a mine for the sake of that assistance which he bargains for in return.

The state of affairs is then changed since M. de Humboldt wrote; and it might be ex-

pected that in now laying before the public a revised Selection from his works, some alteration in those parts relating particularly to the effects of the Government should have been made: but upon consideration this was not deemed advisable; the reader will therefore bear in mind that the descriptions relate to a former period, and not to the present one.

A writer in one of our newspapers has commented on the extraordinary spectacle of a vast country, teeming with the precious metals, applying to the inhabitants of a northern island, comparatively barren in native wealth, for assistance in the extraction of its treasures. It is, indeed, a striking proof that the richest gifts of nature are useless without the industry and intelligence requisite to bring them into action, and that such industry and intelligence are only to be looked for where property is secure and rational liberty is enjoyed.

I had occasion, again, about the year 1819, to consider some circumstances connected with the Mexican mines, owing to the intention of a respectable house in London to send out

a steam-engine to be employed in one of them. A number of interesting papers were then submitted to me, some of them warranted by the name of Don Fausto d'Elhuar, formerly President of the College of Mines at Mexico, and now resident at Madrid. My opinion of the benefits to be expected from such undertakings was much confirmed, and I saw a disposition to favour them on the part of the resident proprietors. I then advised the necessary measures to be taken: an engine was constructed and sent out, accompanied by a miner from Cornwall, Robert Phillips; and this was, I believe, the first equipment of the kind that reached this part of Spanish America. Owing to several circumstances, the engine was not sent to the mine it was intended for, and considerable delay occurred before it reached the place of its ulterior destination; but it is now erected in the mine of Conception in the Real Catorce. I had lately a letter from Phillips, who was in good health and spirits; and the undertaking, as far as I can learn, is likely to be a very successful one.

At the present moment the difficulties I

have alluded to arising from the policy of the former Spanish Government are removed, and it seems probable that the New Government, whatever form it may assume, will follow the direction of its own interests and of the wishes of the people, and will give encouragement to foreign aid in working the mines. The property in them, like that of mines in England, is private; the contracts are therefore made with individuals, many of whom have considerable influence; the State only interferes in taking a duty on the metals when exported, which has lately been lowered with respect to silver from 29½ per cent. to 6 per cent.

Various commercial establishments from this country have been made of late in Mexico, and English gentlemen are resident there; a channel of communication has thus been opened, through which negotiations with England have been carried on for grants or shares in some of the principal mines, and abundant capital has been raised to work them with effect.

The first Company seems to have originated with a proposal from Don Lucas Alaman, a

leading minister in the Mexican Government. It was first promulgated in Paris, under the title of the "Franco-Mexican Company;" but not succeeding there, it was transferred hither, and after some time, and some alteration in the original plan, is now established under the name of the *United Mexican Association*, with a capital of 240,000*l.* in 600 shares of 40*l.* each. The object of this Company is said to be principally to purchase ores and smelt and refine them; it also, according to the prospectus, meditates the working mines, but it does not appear to have yet actually engaged any.

I should think the establishment of a Company to purchase ores of the smaller mines, and to refine them upon a well-conducted system, a promising undertaking; but as I am unacquainted with the details of the plan, I of course refrain from giving any further opinion.

The Company next established is called the "Anglo-Mexican Association," which having actually contracted for some of the

most extensive and productive concerns, has raised a proportionate capital by a subscription of one million in 10,000 shares of 100*l.* each. This Company has done me the honour to consult me on its arrangements; it is governed by twelve Directors of great respectability, and the preparations are in considerable forwardness. The mines undertaken by this association are principally in the Real of Guanaxuato, concerning which a great deal of information will be found in the following pages. Its situation, north-west of the city of Mexico, will be seen by a reference to the map.

The great mine of Valenciana is in this district; of this M. de Humboldt speaks frequently, and ample details as to its produce and other circumstances will be laid before the reader. It is situated upon a lode, or vein, which has been extensively worked, and upon which the Company has other mines, called Tepeyac, Rayas, Cuta and Serena; it has also one which seems to be in another lode, called La Luz, at no great distance: they are negotiating for other mines, which will complete

an undertaking of great magnitude, and adequate to warrant a large and effective establishment.

Valenciana was a dry mine when M. de Humboldt was there, and it has thus been carried to an extraordinary depth; it was holed to Tepeyac, which let down water into it, and since the troubles in 1810 has been gradually filling. There is no adit, and the engines must therefore lift to the surface, where in all probability the stream will be very useful in dressing. Tepeyac will be drained at the same time, and other engines are provided for the smaller mines.

The modes of dressing and particularly of crushing the ores are very imperfect; it is therefore probable, and has indeed been stated from good authority, that large quantities of the former waste lying there, will pay well for working over. Steam stamping engines are constructing for this purpose, and will probably soon enable the proprietors to make some returns.

Instead of smelting, the Mexicans have generally used the process of extracting the sil-

ver by the use of mercury, which is called amalgamation: a full description of this mode will be found, and of the enormous expense and difficulties attending it. There is good reason to believe, that by dressing the ores as clean as possible in the first instance, so as to effect a considerable reduction of their bulk, by a better application of fuel either in good reverberatory furnaces, or in the blast hearths used in the north of England, the silver ores may be smelted with a certain quantity of lead, and afterwards tested off: dispatch and economy will thus be promoted without any serious loss of the precious metals.

The Anglo-Mexican Association has also contracted for a mine, called Purissima, in the Real de Catorce before mentioned, which will be found in the northern part of the map. This is very near the mine where Robert Phillips now is, upon which the steam-engine has been erected.

This district has been very rich, and considerable expectations are, probably with justice, entertained with respect to the future profit.

The third Company is of a more private na-

ture, and is formed of individuals who possess the largest interest in the mines of this country. As I direct the administration of their affairs at home, they have wished me to manage this undertaking abroad, and to organize the establishment which will proceed to Mexico to carry on the works. From among their numerous valuable agents and connexions here, I shall not find this a difficult task. I trust that those who undertake to represent the respective Companies will do credit to their choice, and will show that improvements may be carried into effect without that indiscretion or precipitancy which might cause disgust and opposition.

This last Company is known by the title of "The Adventurers in the Mines of Real del Monte," which is a district about sixty miles north of the city of Mexico. They have agreed with the agent of the Count Regla for his mines on the Biscaina vein and others connected with it. They also have taken the mine of Moran from the proprietor, Thomas Murphy, Esq., who was long resident in Mexico.

The Company's agents will proceed directly to the mines, and engines and proper machinery will be immediately prepared to follow them. The reader will find in the subsequent pages some notice of the mines of Real del Monte on the Veta Biscaina, which is the great lode on which they are worked. Moran is on the same lode, and this mine is curious as having been the only one in which pumps were tried in Mexico. These were worked by a pressure engine (*machine à colonne d'eau*) erected by a German engineer: it succeeded in drawing out the water with 9 inch pumps, 6 feet stroke; and it appears that when it worked 12 hours out of 24, it kept the water clear: the stream, however, which supplied the power was quite insufficient, except in the rainy season, which lasts in Mexico but about three months in the year; the machine was therefore useless, and the mine was abandoned.

The number of mines in Mexico is very great; there are many very important ones besides those engaged by the Companies now formed, and others not even noticed in

the following pages, which have been exceedingly rich, and may become so again. There is no natural rivalry in the business of mining in a district where there is room for the exertions of all; the produce is easily disposed of without injurious competition, and the effect of increased production upon prices is so gradual, that all will participate in its advantages before the consequent depression will be sensibly felt.

No foolish jealousies, therefore, ought to prevail; English miners will carry out the same friendly feelings as exist in their own country, where mutual assistance is cordially afforded, and where the improvement designed by one is freely exhibited to all. Common danger is said to be a bond of union; and the usual risks and uncertainties of mining are sufficient in themselves to induce co-operation in order to overcome them.

Many unforeseen difficulties may be found in a new country, and time, patience, and discretion may be required to avoid and surmount them. New processes or modes of working should be introduced with caution,

and prejudices should be respected, rather than the success of the undertaking should be endangered by injudicious attempts at premature alterations. After the value of an improvement is known and acknowledged, no objection will be made to its adoption: there are few cases where proof of this kind may not be given by small beginnings, and a gradual progress towards perfection may thus be made. The advance may be somewhat slower, but it will be proportionably more sure. The whole business of mining is experimental; hardly a shaft is sunk or a level driven, but it is, as we properly say, for the purpose of trial. The modes in which such trials or experiments may be made, may be various, and there are few but have something to recommend them, or which do not deserve some consideration. A skilful miner knows how to select and combine such operations, and the most unskilful may be guided into the right path by temperate advice and judicious example. I would insist much on this point for the consideration of such persons as may go from England, be-

cause I have seen well-devised projects, even in this country, endangered by hasty and indiscreet measures which encouraged opposition or jealousy.

The Mexican people will eventually be much benefited by the application and use of our steam-engines, and probably by some other improvements we may carry with them. They invite our assistance in a friendly manner, and there is no doubt that the enlightened part of the nation will regard us favourably: we ought to do our part to deserve their confidence and support; a connexion may thus be established which may be beneficial to the present and future generations of both countries. It is impossible to calculate to what extent the exchange of the varied and precious productions of the Mexican soil and climate, for those furnished by English industry and capital, may be hereafter carried.

A perusal of this little book will show what advantages Mexico has received from Nature, and that, as it is free from the embarrassments of a slave population, there is a

fair probability that under a liberal and equitable Government it may rise to a dignity in the scale of enlightened nations, which its extent, position, and internal wealth entitle it to hold.

One of the principal difficulties in the application of machinery will arise from the weight of the parts, and the labour of conveying them through the country to the mines which are at considerable distances from the coast. The principal roads are mentioned by M. de Humboldt, and the improvements contemplated, or in part executed; they are still, however, in places, very bad for wheel carriages, and most of the internal commerce is carried on by the use of mules loaded with the goods they transport; a mode which will be inapplicable to many articles and to their conveyance into deep mines. Nothing is more important to a country than good roads, especially in a country like Mexico, where the elevation of the table-land will probably preclude the use of canals: it may be hoped that, under more tranquil and prosperous political circumstances, the Government will attend to

and devise means for improvements in this important matter.

The subject for the greatest consideration with English miners will be that of fuel, both as it relates to the power to be employed to drain the mines—for which nothing but steam-engines can in our present state of knowledge be contemplated, and as it regards the reduction of the ores. If it should be found that the supply of this most essential article is not too limited, we may indeed promise ourselves considerable success; and we may hope to benefit Mexico not only by our machinery, but by substituting a more economical mode of extracting the precious metals.

Amalgamation is at present the favourite process, and as long as fuel is scarce it may probably remain so; it may even be difficult to overcome prejudice in this respect, and hazardous to venture on hasty measures to alter the practice: but I am of opinion, that if coal in particular, perhaps even turf, which I am told exists in some parts, can be procured, —silver, and perhaps gold also, may be ob-

tained without waste, by the use of means infinitely less expensive than quicksilver.

Various passages in the work will show not only the great charge of this material, which, being hitherto only produced in Spain and Germany, is of very limited supply; but that in fact the silver mines of Mexico have been frequently and most seriously embarrassed for want of it; and this is confirmed to me by recent and authentic information. It will appear from the tables hereafter given, that the produce of gold and silver has been reduced when mercury was scarce, and that on the contrary the Mexican mines flourished when it was abundant. To guard against such variations, I know that it will be necessary for each establishment to keep at all times a large stock of this article at the mines; and that thus, besides the risks of plunder and waste, a greater capital than would otherwise be required must be provided and locked up in a distant country.

As notice will be taken of this subject in the work itself under the proper heads, I shall content myself with insisting strongly on the

necessity of great attention to the operations of dressing or washing the ores. If fuel be scarce, or if quicksilver be expensive, it must be expedient to carry the process of dressing to the furthest point we can, without losing too much of the precious metal:—I say without losing too much, because I know that any kind of dressing must produce some waste; and none but persons who are in possession of all the facts, and can balance one with another, can understand this part of the business. The Assay Office must be frequently consulted, and every thing taken into the account. In England we have different modes of dressing, and they have regulated themselves by gradual experience according to circumstances: fuel with us is cheap; and therefore with copper ores, where fire will refine the metal with less waste than any other mode, we wash but little. In the case of tin ores, which will bear water without much chance of loss, and where the purity of the metal must be obtained by separating it from all other metallic substances before it goes into

the furnace, we clean the ores very accurately. We are induced to dress our lead ores also well, because the metal being easily volatilized and dissipated by strong heats, we endeavour to free the ores from other more infusible substances.

In silver ores we have not much practice, although in some raised from mines of which I have the superintendance in Cornwall, I observe that they bear the water pretty well: my opinion formed upon my past experience, therefore, is, that the waste which will unavoidably result from making them very clean, must be risked under the present circumstances of the Mexican mines; and that the object kept principally in view must be the reduction of the bulk of the ore to its minimum; and this, whether amalgamation be employed or smelting. Silver is indestructible in the fire, and in a strong heat lead will attract it from all other mixtures, and be a faithful carrier to other processes by which it is easily and expeditiously refined.

The operations of dressing, to be conducted

properly, must have the aid of peculiar machinery, and the advantage of skilful persons to direct. The mechanical part of the business seems to be very rude in Mexico, and wholly inadequate to perform what is required in a proper manner: our stamping mills, crushing rollers, and other apparatus will be of the greatest use, and of general application; but these will do but little, unless directed by competent judgement and experience. The persons proper to manage dressing in Mexico, will in my opinion be found amongst those who are brought up in our tin mines. Copper and lead ore dressers will not be attentive enough to minute particulars.

The prospect of advantage to the capitalists who embark their money in mining in Mexico is subject to be clouded by many doubts respecting the political circumstances of a new Government, the difficulty of exercising controul over establishments to which great discretionary powers must be confided at a formidable distance from home, and the impediments likely to arise from the prejudices

or avarice of the Mexicans. These, however, though serious risks, may perhaps be overrated by many; and I am inclined to think may be moderated by a prudent selection of the agents who are to represent British interests in Mexico. The proprietors of the mines there in making their grants, and the Government in their laws relating to property of this kind, will consult their own interest in a faithful and liberal encouragement of foreign aid; and I know of no good reason to doubt that this will be afforded. On the part of those to whom the direction and working of the mines in Mexico are intrusted, there ought to be unremitting attention to carry on their operations with vigour and effect, rendering to the proprietors, with the portion of the profits to which they are entitled, an example of skilful management and an exact observance of the rights of all parties concerned.

With a good understanding founded on such a basis, and with discretion on the part of those who may direct the affairs of the Companies at home and abroad, I can see no

obstacle to the prosperity of these mines, which does not equally present itself in the case of those in remote counties of England.

If no unforeseen circumstances arise to disturb the arrangements which are made for the conduct of the undertakings, and if I am to look to the mining risk simply, I cannot come to any other opinion, than that this is very small, or rather I should say that the expectation of profit is a large one.

The veins are of an unusual width, and have in many cases been worked on in several points for a great length, and are proved extensively; the quantity of ore which has been raised is enormous; the quality, though not (as M. de Humboldt says) in itself rich, because the mass is so great, may yet be deemed comparatively so, when reduced in bulk, as it may be, and when considered with relation to what English mines produce; the metals are of the highest value, while the expenses need no be greater than they would be in the same place for mines worked in veins inferior in the quantity or quality of their produce.

These advantages are so great that they

may compensate for many errors and many difficulties; and if such occur at first, as in all probability they may, I cannot but indulge sanguine expectations that zeal, patience and skill will overcome them, and that finally the enterprise will be as profitable as the risks encountered may fairly require it should be.

I freely admit that I am deeply interested in the success of these adventures, that I feel an unusual degree of anxiety for their success, and that to this end I shall gladly contribute the utmost exertion of my humble efforts. I may therefore be considered a partial adviser. I have endeavoured, however, to leave the facts as I found them, standing on authority which has not been questioned. From these, judicious readers will draw their own conclusions.

JOHN TAYLOR.

Bedford Row,
12th March, 1824.

RECENT MEMORIAL

TO

THE SOVEREIGN CONGRESS

OF

MEXICO.

SINCE the completion of this work, I have been favoured with the following extract of a memorial presented to the Government of Mexico at a very late period, by an enlightened and liberal minister of that country, Don Lucas Alaman, and which I have the greatest pleasure in making public. It is remarkable for the justness of the views it gives of the means of encouraging their great sources of national wealth; and if such principles are acknowledged and acted upon, which there is no good reason to doubt, I will venture to predict that foreign capital will be employed with confidence, and with benefit to the country where it is employed as well as to that which may supply it, the advantage to each particular Company who may

undertake mines, being of course more or less as they may prudently and skilfully manage their affairs. J. T.

Extract from the Report of the Minister for Foreign Affairs and of the Interior to the Sovereign Constituent Congress assembled in Mexico, 1st November 1823, *(received by a late arrival from Mexico.)*

ARTICLE INDUSTRY.

MINES.

It is a principle admitted by all writers on political economy, that the most direct encouragement that can be given to agriculture and to industry, is to facilitate the consumption of the produce of the one, and the sale of the manufactures of the other. If the mines be considered amongst us under this point of view, it will be found that nothing contributes so much as they do to the prosperity of those essential branches of the public riches. The great number of people that are occupied in them, the animals that are employed in the working of the machinery, and in transporting the ores, the consumption that arises therefrom of grain, as well as of soap, paper, iron, &c., give a powerful impulse to agriculture, the arts, and to commerce. If practical illustration be necessary to prove those facts, which are doubted only by men whose minds are preoccupied by the paradoxical assertions of systematic economists, they may be found on a comparison of the state of our mining provinces,

such as Guanaxuato and Zacatecas, previous to the year 1810 and at the present period. Abundance and prosperity then reigned throughout both of them. The agriculturist found in those famous reales (districts) a ready and certain market for his produce ; the smith, the carpenter, the mason, a constant employment for his industry ; the merchant an extensive consumption for the goods which he introduced ; and the treasures drawn from the bowels of the earth were distributed throughout and revivified the most distant provinces in payment for the soap, wood, salt, magistral, horses and mules, that were brought from all parts. The nature of our ores is also a powerful cause of these happy results ; they are generally poor in metal, and most abundant in quantity, and require for their manufacture a great quantity of machinery and ingredients ; and it may therefore be said that the miner merely draws forth funds to distribute them freely among the labourers, merchants and artisans ; and we must naturally conclude that the prosperity of these classes depends principally upon the impulse given to them by the mines, which in our notion are thus the acting principle of all the other branches of industry.

From this it is to be inferred that the encouragement which is given to the former revolves indirectly in favour of the latter ; and if it be intended to animate the one, we must begin by giving a stimulus to the other. These principles

occasioned the reduction of duties granted by the Spanish Cortes, and confirmed by the Provincial Junta, a reduction that has unexpectedly preserved the mines at this time, and which may greatly contribute to re-establish them.

We may flatter ourselves that we shall speedily see them once more in a flourishing condition. Several foreign capitalists are ready to invest large funds in draining and working the principal mines, which, from the disastrous consequences of the war, have been overflowed and not regularly worked. The steam engines, which it is intended to introduce, and of which two are now erecting, the one in Temascaltepec and the other in Real de Catorce, will powerfully contribute to so important a result. The former Sovereign Congress, with the intention of facilitating contracts of supply with opulent foreigners, with whom some have already been concluded, abolished the laws and articles of the ordinance which prohibited them from acquiring property in mines, although it wisely limited the power which it granted to them for that purpose to those mines only which they may supply, without being able to denounce others, or to attempt to discover new ones. This measure will be a new stimulus to the introduction of funds for the supply of this branch, which it so much needs, and which it cannot procure by other means.

The "Tribunal of Mines," which, according to the terms of its constitution ought to have been a

bank of supply, by creating for this important object under its direction, a fund out of the duty of one rial per mark of silver, cannot at the present time afford any assistance to the miners, and which they so imperatively stand in need of, as from causes which the limits I am obliged to prescribe to this memorial do not allow me to dilate upon. Such a fund not only does not exist, but, on the contrary, this body is loaded with a debt, the interest of which cannot be paid out of the produce of the aforesaid duty.

Another of the means of encouragement which it would be proper to grant to this important branch, so soon as circumstances shall permit, is the establishment of exchange houses, which formerly existed, and the creation of new ones on these points where it may be most expedient.—They facilitate the activity of the circulation, and thereby the frequent employment of the same capital, which may be said to multiply itself by being repeatedly invested, thus avoiding the necessity of increasing the number of mint houses, the quantity of which must greatly augment the expenses of coinage.

ERRATA.

Running title, p. 101, *for* roads *read* road.
——— ——— p. 165, *for* exported *read* extracted.
——— ——— p. 198, *for* mines *read* miners.
Note 1, p. 226, *for* influence *read* inference.
Page 228, table, col. 4, *for* leagues *read* miles. Col. 5, *for* league *read* mile; *for* 695 *read* 65.

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CONTENTS.

CHAPTER I.

Kingdom of Mexico—situation—territorial division—favourable position of mining districts—rivers—lakes—roads..... *page* 1

CHAPTER II.

City of Mexico—situation—population—buildings—surrounding country—scientific establishments—progress of opinion—distribution of property..... 25

CHAPTER III.

Climate—variety under the same latitude—rains—general salubrity—fertility of the soil—corn, fruits—cattle—general improvement in agriculture—influence of mines on agriculture—habits of Indian cultivators.... 42

CHAPTER IV.

Population—number and character of native Indians—comparison between the population of Mexico and that of the United States—small number of negro slaves—increase of population—census of 1794 59

CONTENTS.

CHAPTER V.

Manufactures—powder manufactory—goldsmiths—mint—interior commerce—foreign commerce—smuggling—average value of exports and imports ..... page 75

CHAPTER VI.

Intendancy of Vera Cruz—situation—physical aspect—climate—productions—road from the capital to Vera Cruz port—yellow fever..... 95

CHAPTER VII.

Mineral productions—quantity of gold and silver—copper, tin, iron, lead, mercury, coal, salt..... 110

CHAPTER VIII.

Geological description of the mining districts of Mexico 130

CHAPTER IX.

Geological constitution of mines—position and extent of mineral veins—elevation of mines—comparative wealth of mines—distance between principal mines—nature of ores—mean riches of ores..... 160

CHAPTER X.

Numbe of mines—laws respecting mines—quantity of silver raised—state of mining operations—condition of mines—smelting—amalgamation..... 180

CHAPTER XI.

Intendancy of Guanaxuato—situation—extent—cultivation—population—towns—mining districts—geological constitution 228

CHAPTER XII.

Intendancy of Zacatecas—extent—towns—mines—geological structure 250

CONTENTS.

CHAPTER XIII.

Intendancy of San Luis Potosi—extent—climate—territorial division—towns—mines—wealth of the mine of Catorce..... page 256

CHAPTER XIV.

Intendancy of Mexico—extent—climate—physical aspect—roads—principal towns—mines—Real del Monte, Moran Biscaina, Tasco—state of mining operations—geological structure..... 264

CHAPTER XV.

Intendancy of Guadalaxara—extent—climate—agricultural produce—principal towns—mines..... 286

CHAPTER XVI.

Intendancy of Valladolid—extent—Volcan de Jorullo—vegetable productions—earthquakes—volcanoes—population—principal towns—mines..... 291

CHAPTER XVII.

Summary recapitulation—physical aspect—climate—territorial extent—population—agriculture—mines—manufactures—commerce—revenue—military defence..... 303

The marginal references of the original to the various works and documents by which the author confirms his statements, are omitted in this little work. It is presumed that any one who wishes to verify a fact which appears to him suspicious, will not think it too much trouble to consult the original, or Mr. Black's translation.

SELECTIONS

RELATIVE TO

MEXICO.

CHAPTER I.

Kingdom of Mexico—situation—territorial division—favourable position of mining districts—rivers—lakes—roads.

Among the colonies subject to the king of Spain, Mexico occupies the first rank, both on account of its territorial wealth, and on account of its favourable position with Europe and Asia. We speak here merely of the political value of the country, considering it in its actual state of civilization, which is very superior to that of the other Spanish possessions. Many branches of agriculture have undoubtedly attained a higher degree of perfection in the province of Caraccas than in New Spain. The fewer mines a colony has, the more is the industry of the inhabitants turned towards the productions of the vegetable kingdom. The fertility of the soil is greater in the provinces of Cumana, of New Barcelona, and Venezuela, on the banks of the lower Orinoco, and in the northern parts of New Grenada, than in the king-

dom of Mexico, of which several regions are barren, destitute of water, and incapable of vegetation. But when we consider the greatness of the population of Mexico, the number and proximity of its considerable cities, the enormous value of its metallic produce, and its influence on the commerce of Europe and Asia;—when we examine the imperfect state of cultivation observable in the rest of Spanish America, we are tempted to justify the preference which the court of Madrid has long manifested for Mexico above its other colonies.

The denomination of New Spain designates, in general, the vast extent of country over which the viceroy of Mexico exercises his power. Using the word in this sense, we are to consider as northern and southern limits the parallels of the 38th and 10th degrees of latitude.

The advantages afforded by this vast empire, from the wealth of its natural productions, the fertility of its soil, the facility which a man possesses there of choosing, with thermometer in hand, in a space of a few square leagues, the temperature or climate which he believes the most favourable to his age, his physical constitution, or to the species of cultivation to which he is most attached, appear to be unrivalled. Nothing can exceed the beauty of those delicious countries, situated half way up the ascent, in the region of oaks and pines, between 3,000 and 5,000 feet above the level of the sea; where a perpetual spring reigns, where the

most delicious fruits of the Indies are cultivated beside those of Europe, and where these enjoyments are troubled neither by a multitude of insects, nor by the fear of the yellow fever (*vomito*), nor by the frequency of earthquakes. There does not exist a region in which man, with less labour, can supply more abundantly the wants of a numerous family.

In the short statistical account we shall give of New Spain, we shall confine ourselves to those subjects which are interesting considered with relation to the important science of political economy. The face of a country, the grouping of its mountains, the extent of its plains, the elevation which determines their temperature; every thing, in a word, which regards the construction of the earth, has the most intimate connexion with the progress of the population and the welfare of its inhabitants. It is this construction which influences the state of agriculture, varied according to the variations of climate, the facility of internal commerce, more or less favoured by the nature of the ground: lastly, the military defence, on which depends the external safety of the colony. These are the only considerations which can render geological descriptions interesting to the statesman, when he calculates the territorial force and riches of nations.

The Kingdom of New Spain, to which the capital city and seat of government has given the name of the Kingdom of Mexico, the most northern part of all Spanish America, extends from the 16th to the

38th degree of north latitude. The length of this vast region, in the direction of S.S.E. to N.N.W., is about 1,800 miles; its greatest breadth lies under the 30th degree. From the Red River in the province of Texas, to the island of Tiburon on the coasts of the intendancy of Sonora, it measures from east to west 1,100 miles. This space of seventy-nine degrees equals not only the length of all Africa, but even much surpasses the breadth of the Russian empire, which includes about a hundred and sixty-seven degrees of longitude, under a parallel of which the degrees are not more than half the degrees of the equator.

In its present state New Spain is divided into twelve intendancies, to which we must add three other districts, very remote from the capital, which have preserved the simple denomination of provinces. These fifteen divisions are,

I. UNDER THE TEMPERATE ZONE, 738,000 square miles, with 677,000 souls, or rather less than one inhabitant to the square mile.

A. REGION OF THE NORTH, an interior region.

1. *Provincia de Nuevo Mexico,* along the Rio del Norte to the north of the parallel of 31°.
2. *Intendencia de Nueva Biscaya* to the south-west of the Rio del Norte, on the central table-land which declines rapidly from Durango towards Chihuahua.

B. Region of the north-west, in the vicinity of the Great Ocean.

3. *Provincia de la Nueva California*, or north-west coast of North America, possessed by the Spaniards.

4. *Provincia de la Antigua California*. Its southern extremity enters the torrid zone.

5. *Intendencia de la Sonora*. The most southern part of Cinaloa, in which the celebrated mines of Copala and Rosario are situated, also passes the tropic of Cancer.

C. Region of the north-east, adjoining the Gulf of Mexico.

6. *Intendencia de San Luis Potosi*. It comprehends the provinces of Texas, la colonia de Nuevo Santander and Cohahuila, El Nuevo Reyno de Leon, and the districts of Charcas, Altamira, Catorce, and Ramos. These last districts compose the intendancy of San Luis properly so called. The southern part, which extends to the south of the Barra de Santander and the Real de Catorce, belongs to the torrid zone.

II. UNDER THE TORRID ZONE, 328,500 square miles, with 5,160,000 souls, or rather more than 15 inhabitants to the square mile.

D. Central region.

7. *Intendencia de Zacatecas*, excepting the

part which extends to the north of the mines of Fresnillo.

8. *Intendencia de Guadalaxara.*
9. *Intendencia de Guanaxuato.*
10. *Intendencia de Valladolid.*
11. *Intendencia de Mexico.*
12. *Intendencia de la Puebla.*
13. *Intendencia de Vera Cruz.*

E. REGION OF THE SOUTH-WEST.

14. *Intendencia de Oaxaca.*
15. *Intendencia de Merida.*

The divisions in this table are founded on the physical state of the country. We see that nearly seven eighths of the inhabitants live under the torrid zone. The population becomes thinner as we advance towards Durango and Chihuahua. In this respect New Spain bears a striking analogy to Hindostan, which in its north parts is bounded by regions almost uncultivated and uninhabited. Of five millions who inhabit the equinoctial part of Mexico, four-fifths live on the ridge of the Cordillera, or table-lands, whose elevation above the level of the sea equals that of the passage of Mount Cenis.

New Spain, considering its provinces according to their commercial relations, or the situation of the coasts, is divided into three regions.

I. PROVINCES OF THE INTERIOR, which do not extend to the ocean.

1. *Nuevo Mexico.*
2. *Nueva Biscaya.*
3. *Zacatecas.*
4. *Guanaxuato.*

II. MARITIME PROVINCES *of the eastern coast* opposite to Europe.

5. *San Luis Potosi.*
6. *Vera Cruz.*
7. *Merida,* or *Yucatan.*

III. MARITIME PROVINCES *of the western coast* opposite to Asia.

8. *New California.*
9. *Old California.*
10. *Sonora.*
11. *Guadalaxara.*
12. *Valladolid.*
13. *Mexico.*
14. *Puebla.*
15. *Oaxaca.*

These divisions will one day possess great political interest, when the cultivation of Mexico shall be less concentrated on the central table-land or ridge of the Cordillera, and when the coasts shall become more populous. The maritime provinces of the west will send their vessels to Nootka, to China, and the East Indies. The Sandwich islands, inhabited by a ferocious but industrious and enterprising people, appear destined to re-

ceive Mexican rather than European colonists. They afford an important *entrepôt* to the nations who carry on commerce in the Great Ocean. The inhabitants of New Spain and Peru have never yet been able to profit by their advantageous position on a coast opposite to Asia and New Holland. They do not even know the productions of the South Sea islands. The bread-fruit tree, sugar-cane of Otaheite,—that precious reed, the cultivation of which has had such a happy influence on West India commerce,—will one day be received by them from Jamaica, the Havannah, and Caraccas, and no longer from the adjoining islands. What efforts have not been made by the United States of North America, within the last ten years, to open a communication with the western coast, with that same coast on which the Mexicans possess the finest ports, but without activity and without commerce!

According to the ancient division of the country, the *Reyno de Nueva Galicia* contained more than 126,000 square miles, and nearly a million of inhabitants: it included the intendancies of Zacatecas and Guadalaxara *, as well as a small part of that of San Luis Potosi. The regions now known by the denomination of the seven intendancies of Guanaxuato, Valladolid or Mechoacan, Mexico, Puebla, Vera Cruz, Oaxaca, and Merida, formed,

* With the exception of the most southern part, which contains the volcanos of Colima and the village of Ayotitan.

along with a small portion of the intendancy of San Luis Potosi*, the *Reyno de Mexico*, properly so called. This kingdom consequently contained more than 243,000 square miles, and nearly four millions and a half of inhabitants.

Another division of New Spain, equally ancient and less vague, is that which distinguishes *New Spain, properly so called*, from the *provincias internas*. To the latter belongs all to the north and north-west of the kingdom of Nueva Galicia, with the exception of the two Californias; consequently, 1. the small kingdom of Leon; 2. the colony of New Santander; 3. Texas; 4. New Biscay; 5. Sonora; 6. Cohahuila; and 7. New Mexico. The *provincias internas del Vireynato*, which contain 70,326 square miles, are distinguished from the *provincias internas de la Comandancia* (of Chihuahua), erected into a *capitania general* in 1779, which contain 534,375 square miles. Of the twelve new intendancies, three are situated in the *provincias internas*, Durango, Sonora, and San Luis Potosi. We must not, however, forget that the intendant of San Luis is only under the direct authority of the viceroy for Leon, Santander, and the districts near his residence, those of Charcas, Catorce, and Altamira. The governments of Cohahuila and Texas make also part of the intendancy of San Luis

* The most southern part, through which the river of Panuco runs.

Potosi; but they belong directly to the *comandancia general de Chihuahua.* The following tables will throw some light on these very complicated territorial divisions. Let us divide all New Spain into

A. *Provincias sujetas al Virey de Nueva España;* 531,927 square miles, with 5,477,900 souls: the ten intendancies of Mexico, Puebla, Vera Cruz, Oaxaca, Merida, Valladolid, Guadalaxara, Zacatecas, Guanaxuato, and San Luis Potosi (without including Cohahuila and Texas).
The two Californias.

B. *Provincias sujetas al Comandante general de provincias internas,* 534,375 square miles, with 359,200 inhabitants:
The two intendancies of Durango and Sonora;
The province of Nuevo Mexico;
Cohahuila and Texas.

The whole of New Spain, 1,066,302 square miles, with 5,837,100 inhabitants.

We have given this brief outline of the territorial divisions of the whole of this vast empire: but as it forms no part of our purpose to extend the views of our readers beyond those intendancies which are the seat of the great mining operations, we shall, in the more detailed description which follows, confine ourselves principally within the intendancies of Guanaxuato, Mexico, Zacatecas, San Luis

Potosi, Valladolid, and Guadalaxara. The only instance in which we shall exceed this boundary, is in that of Vera Cruz, which is interesting as the province through which all the riches of the interior pass to Europe.

The chain of mountains which form the vast table-land of Mexico, is the same with that which, under the name of the Andes, runs through all South America; but the construction, I may say the skeleton (*charpente*), of this chain varies to the south and north of the equator. In the southern hemisphere, the Cordillera is every where torn and interrupted by fissures, like open furrows not filled with heterogeneous substances. If there are plains elevated from 10,000 to 12,000 feet, as in the kingdom of Quito, and further north in the province of los Pastos, they are not to be compared in extent with those of New Spain, and are rather to be considered as longitudinal valleys bounded by two branches of the great Cordillera of the Andes: while in Mexico it is the very ridge of the mountains which forms the table-land; and it is the direction of this plain which designates, as it were, that of the whole chain. Peru and the kingdom of New Grenada contain transversal valleys, of which the perpendicular depth is sometimes near 5,000 feet. The existence of these valleys prevents the inhabitants from travelling except on horseback, a-foot, or carried on the shoulders of Indians (called *cargadores*); but in the kingdom of New Spain carriages roll on to Santa

Fe in the province of New Mexico, for a length of more than 1,500 miles. On the whole of this road there were few difficulties for art to surmount.

The table-land of Mexico is in general so little interrupted by valleys, and its declivity is so gentle, that as far as the city of Durango, in New Biscay, 420 miles from Mexico, the surface is continually elevated from 5,600 to 8,900 feet above the level of the neighbouring ocean. This is equal to the height of Mount Cenis, St. Gothard, or the Great St. Bernard.

A remarkable advantage for the progress of national industry arises from the height at which nature, in New Spain, has deposited the precious metals. In Peru the most considerable silver mines, those of Potosi, Pasco, and Chota, are immensely elevated, and border upon the region of perpetual snow. In working them, men, provisions, and cattle, must all be brought from a distance. Cities situated in plains, where water freezes the whole year round, and where trees never vegetate, can hardly be an attractive abode. Nothing can determine a freeman to abandon the delicious climate of the valleys to insulate himself on the top of the Andes, except the hope of amassing wealth. But in Mexico, the richest veins of silver, those of Guanaxuato, Zacatecas, Tasco, and Real del Monte, are at moderate elevations of from 5,000 to 6,000 feet. The mines are surrounded with cultivated fields, towns, and villages; the neighbouring sum-

mits are crowned with forests; and every thing facilitates the acquisition of this subterraneous wealth.

None of the plains of New Grenada, Quito, or Peru exceed 360 square miles. Of difficult access, and separated from one another by deep valleys, they are very unfavourable for the transport of goods and internal commerce. Crowning insulated summits, they appear like islands in the middle of the aërial ocean. Those who inhabit these frozen plains remain fixed there, and dread to descend into the neighbouring regions, where a suffocating heat prevails, prejudicial to the primitive inhabitants of the higher Andes.

In Mexico, however, the soil assumes a different aspect. Table-lands of a great extent, but of a surface no less uniform, are so approximated to one another, that they form but a single plain on the lengthened ridge of the Cordillera: such is the table-land which runs from 18° to 40° of north latitude. Its length is equal to the distance from Lyons to the tropic of Cancer, which traverses the great African desert. This extraordinary plain appears to decline insensibly towards the north.

Further to the north of the parallel of 19°, near the celebrated mines of Zimapan and the Doctor, situated in the intendancy of Mexico, the Cordillera takes the name of Sierra Madre; and then leaving the eastern part of the kingdom it runs to the north-west, towards the cities of San Miguel el Grande and Guanaxuato. To the north of this

last city, considered the Potosi of Mexico, the Sierra Madre becomes of an extraordinary breadth. It divides immediately into three branches, of which the most eastern runs in the direction of Charcas and the Real de Catorce, and loses itself in the new kingdom of Leon.

In travelling from the capital of Mexico to the great mines of Guanaxuato, we remain at first for 30 miles in the valley of Tenochtitlan, elevated 7,500 feet above the level of the sea. The level of this beautiful valley is so uniform, that the village of Gueguetoque, situated at the foot of the mountain of Sincoque, is only 32 feet higher than Mexico. The hill of Barientos is merely a promontory which stretches into the valley. From Gueguetoque we ascend near Botas to Puerto de los Reyes, and from thence descend into the valley of Tula, which is 380 feet lower than the valley of Tenochtitlan, and across which the great canal of evacuation of the lakes San Christoval and Zumpango passes to the Rio de Moctezuma and the Gulf of Mexico. To arrive at the bottom of the valley of Tula, in the great plain of Queretaro, we must pass the mountain of Calpulalpan, which is scarcely 9000 feet above the level of the sea, and is consequently less elevated than the city of Quito, though it appears the highest point of the whole road from Mexico to Chihuahua. To the north of this mountainous country begin the vast plains of S. Juan del Rio, Queretaro, and Zelya, plains covered with villages and con-

siderable cities. Their mean height equals that of Puy de Dôme in Auvergne, and they are near 90 miles in length, extending to the foot of the metalliferous mountains of Guanaxuato.

In the midst of so many advantages bestowed by nature upon New Spain, it suffers in general, like Old Spain, from the want of water and navigable rivers.

In the whole equinoctial part of Mexico there are only small rivers, the mouths of which are of considerable size. The narrow form of the continent prevents the collection of a great mass of water. The rapid declivity of the Cordillera abounds more properly with torrents than rivers. Mexico is in the same state with Peru, where the Andes approach so near to the coast as to occasion the aridity of the neighbouring plains. Among the small number of rivers in the southern part of New Spain, the only ones which may in time become interesting for internal commerce are, 1. The Rio Guasacualco, and the Rio Alvarado, both to the south-east of Vera Cruz, and adapted for facilitating the communication with the kingdom of Guatimala; 2. The Rio de Moctezuma, which carries the waters of the lakes and valley of Tenochtitlan to the Rio de Panuco, and by which, forgetting that Mexico is elevated above 7,000 feet above the level of the sea, a navigation has been projected between the capital and the western coast; 3. The Rio de Zacatula; 4. The great

river of Santiago, formed by the junction of the rivers Lerma and las Laxas, which might carry the flour of Salamanca, Zelaya, and perhaps the whole intendancy of Guadalaxara, to the port of San Blas, or the coast of the Pacific Ocean.

The lakes with which Mexico abounds, the greater part of which appear annually on the decline, are merely the remains of immense basins of water, which appear to have formerly existed on the high and extensive plains of the Cordillera. We shall merely mention the great lake of Chapala in New Gallicia, of nearly 1,400 square miles, double the size of the lake of Constance; the lakes of the valley of Mexico, which include a fourth part of its surface; the lake of Patzcuaro, in the intendancy of Valladolid, one of the most picturesque situations which I know in either continent; and the lakes of Mextitlan and Parras in New Biscay.

The roads of Mexico are either carried along the central table-land itself, from Oaxaca to Santa Fe, or they lead from the table-land towards the coast. The former serve to carry on a communication between the towns on the ridge of the mountains, in the coldest and most populous region of the kingdom; the latter are destined for foreign commerce, and for the intercourse which subsists between the interior and the ports of Vera Cruz and Acapulco: they also facilitate an exchange between the productions of the mountains

and the burning plains of the coast. The roads of the table-land running from the S.S.E. to the N.N.W., which from the general configuration of the country we might call *longitudinal*, are very easily kept up. We shall not repeat in this place what we have already stated, relative to the extent and continuity of the high plains of Anahuac, where we find neither fissure nor ravine, and to the progressive fall of the table-land from 8,200 to 2,600 feet of absolute height. Carriages may run from Mexico to Santa Fe, in an extent exceeding the length which the chain of the Alps would have, if prolonged without interruption from Geneva to the shores of the Black Sea. In fact, the central table-land is crossed in all directions in four-wheel carriages, from the capital to Guanaxuato, Durango, Chihuahua, Valladolid, Guadalaxara, and Perote; but in the present bad state of the roads, waggons are not established for the conveyance of goods. The inhabitants give the preference to the employment of beasts of burden; and thousands of horses and mules in long files *(requas)* cover the roads of Mexico. A considerable number of Mestizoes and Indians are employed to conduct these caravans. Preferring a wandering life to any sedentary occupation, they pass the night in the open air, or in sheds, *(tambos*, or *casas de communidad,)* which are constructed in the middle of the villages for the convenience of travellers. The mules feed at liberty in the

savannahs; but when the great droughts have parched up the grass, the drivers feed them on maize either in herb *(zacate)*, or in grain.

The introduction of camels would be exceedingly useful in Mexico. The table-lands over which the great roads pass are not sufficiently elevated for the cold to be prejudicial to these animals; and they would suffer less than horses and mules from the aridity of the soil, and the want of water and pasturage to which the beasts of burden are exposed to the north of Guanaxuato, especially in the desert by which New Biscay is separated from New Mexico.

The roads which lead from the interior table-land to the coasts, and which I call transversal, are the most difficult, and chiefly deserve the attention of Government. The roads from Mexico to Vera Cruz and Acapulco, from Zacatecas to New Santander, from Guadalaxara to San Blas, from Valladolid to the port of Colima, and from Durango to Mazatlan passing by the western branch of the Sierra Madre, all belong to this class. The roads by which the capital carries on a communication with the ports of Acapulco and Vera Cruz, are of course the most frequented. The value of the precious metals, of the agricultural productions, and of the goods of Europe and Asia which flow through these two channels, amounts to the total sum of nearly 14,000,000*l.* sterling per annum. These treasures pass along a road which resembles that of Airolo at the hospital of

Saint Gothard. From the village of Vigas to L'Encero, the road to Vera Cruz is frequently nothing but a narrow and crooked path, and the most difficult, perhaps, in all America, with the exception of that by which the goods of Europe are transported from Honda to Santa Fe de Bogota, and from Guayaquil to Quito.

The productions from the Philippine Islands and Peru, arrive by the road from Mexico to Acapulco. It is carried along a less rapid slope of the Cordilleras, than the road leading from the capital to Vera Cruz. In the European road we remain, from the valley of Mexico to beyond Perote, on the central plain, at an elevation of 7,550 feet above the level of the ocean; and from that village we descend with extreme rapidity to the ravine of the *Plan del Rio*, to the west of Rinconada. On the other hand, on the road from Acapulco, which we designate by the name of the Asiatic Road, the descent begins at a distance of twenty-four miles from Mexico, on the southern slope of the basaltic mountain of Guarda.

The construction and embellishment of a new road from Mexico to the port of Vera Cruz has latterly become the object of the solicitude of Government. A fortunate rivalry is displayed between the new Council of Commerce established at Vera Cruz, under the name of *Real tribunal del consulado*, and the old *Consulado* of the capital; and the latter is gradually beginning to shake off

the inactivity with which it has so long been reproached. The merchants of Mexico, having constructed at their expense an excellent causeway along the heights of Tiangillo and *las Cruzes*, which separate the basin of Toluca from that of Mexico, wish the new road of Vera Cruz to pass through Orizaba; while the merchants of Vera Cruz who have country-houses at Xalapa, and who maintain numerous commercial relations with that town, insist that the new carriage road *(camino carretero)* should go by Perote and Xalapa. After a discussion of several years, the *Consulado* of Vera Cruz profited by the arrival of the viceroy, Don Josef de Yvirigarras, who declared himself in favour of the road by Xalapa as of the greatest utility, and who gave the direction of it to M. Garcia Conde, an active and intelligent engineer.

The old road from Mexico to Xalapa and Vera Cruz passed along the elevated plains of Apa, without touching the great town of Puebla de los Angeles. The indigenous merchandises and productions were then conveyed from Mexico to Perote and Xalapa, by a very circuitous route. They reckoned by this road, 130 miles from Mexico to Perote, and 220 from Mexico to Vera Cruz. At last a new and very short road was opened by the Venta de Chalco, the small chain of porphyritic mountains of Cordova, Tesmelucos, and Ocotlan. The advantages of these more direct communications between the capital, the city of Puebla, and the fortress of Perote,

will be easily discovered by examining an atlas of New Spain.

The new road from Mexico to Puebla still possesses the inconsiderable difficulty of the passage of the mountains, which separate the basin of Tenochtitlan from that of Cholula. The table-land which extends from the foot of the volcanoes of Mexico to the mountains of Orizaba and the Coffre, is a level plain, covered with sand, fragments of pearled rock, and saline efflorescences. The road from Puebla to Vera Cruz passes through Cocosingo, Acaxete and Perote. We imagine we are travelling over a surface levelled by being long covered with water. When these plains are heated by the solar rays, they exhibit at the height of the passage of Saint Bernard, the same phenomena of suspension and extraordinary refraction, which we generally observe only in the neighbourhood of the ocean.

To the activity of the Consulado of Vera Cruz we owe not only the undertaking of the road of Perote, which in 1803 cost from six to seven thousand pounds per mile, but also the amelioration of the hospitals, and the construction of a beautiful gyratory light-house, executed at London after the plan of the celebrated astronomer *M. Mendoza y Rios*. This light-house consists of a very elevated tower, placed at the extremity of the castle of San Juan d'Ulua, which, with the lantern, cost nearly, 20,000*l*. The lamps, with a current of air,

and furnished with reflectors, are fixed on a triangle which turns by means of clock-work; so that the light disappears whenever the machine presents one of its angles to the entry of the port. At my departure from Vera Cruz, the Consulado were occupied with two new projects of equal utility,—the supplying the town with potable water, and the construction of a mole, which, advancing in the form of a pier, may resist the shock of the waves.

The magnificent road constructing from Perote to Vera Cruz will rival those of the Simplon and Mount Cenis. It is broad, solid, and of a very gentle fall. They have not followed the track of the old road, which was narrow and paved with basaltic porphyry, and which appears to have been constructed towards the middle of the eighteenth century. Rapid ascents have been carefully avoided; and the charge which is brought against the engineer, of lengthening the road too much, will be abandoned when wheel carriages shall be substituted for the carriage of goods on the backs of mules. The construction of this road will probably cost more than 600,000*l.* sterling; but we hope that so beautiful and useful a work will not suffer any interruption. It is an object of the highest importance to those parts of Mexico the most remote from the capital, and from the port of Vera Cruz; for when the road shall be completed, the price of iron, mercury, spirituous liquors, paper, and all the other commodities of Europe,

will experience a sensible fall. The Mexican flour, which has hitherto been dearer at the Havannah than the flour of Philadelphia, will be naturally preferred to the latter; the exportation of the sugars and hides of the country will be more considerable; and the transportation of goods on waggons will require a much smaller number of mules and horses than are now employed. These changes will produce a double effect on subsistence; and the scarcities which have hitherto almost periodically desolated Mexico will be more rare; not only because the consumption of maize will be less, but because the agriculturist, stimulated by the hope of selling his flour at Vera Cruz, will appropriate more of his land to the cultivation of wheat.

During my stay at Xalapa in the month of February 1804, the new road constructed under the direction of Don Garcia Conde, had been commenced on those points which presented the greatest difficulties; namely, the ravine called the *Plan del Rio*, and the *Cuesta del Soldado*. It is intended to place columns of porphyry along the road, for the purpose of indicating both the distances and the elevation of the surface above the level of the ocean. These inscriptions, which are no where to be met with in Europe, will be particularly interesting to a traveller who is climbing the eastern ascent of the Cordillera; they will quiet his mind, by announcing to him that he is approaching that fortunate and elevated region, in which the scourge

of the *black vomit*, or yellow fever, is no longer to be dreaded.

The old road of Xalapa leads from Rinconada eastward, by the old Vera Cruz vulgarly called *la Antigua*. After passing below this village the river of the same name, 650 feet in breadth, we follow the coast by Punta Gorda and Vergara; or if the tide is high, we take the road of la Manga de Clavo, which does not rejoin the coast till the very port of Vera Cruz. It would be advantageous to construct a bridge over the Rio de la Antigua, near la Ventilla, where the bed of the river is only 350 feet in breadth, by which means the Xalapa road would be shortened more than 18 miles; and without touching old Vera Cruz, it would lead immediately from the Plan del Rio, by the bridge of la Ventilla, Passo de Ovejas, Cienega de Olocuatla, and Loma de San Juan, to Vera Cruz. This change is so much the more desirable, as it is the journey from Encero to the coast which is the most dangerous to the health of the inhabitants of the interior of Mexico, when they descend from the table-land of Perote and the heights of Xalapa.

CHAPTER II.

City of Mexico—situation—population—buildings—surrounding country—scientific establishments—progress of opinion—distribution of property.

The situation of the city of Mexico possesses inestimable advantages, if we consider it with relation to its intercourse with the rest of the civilized world. Placed on an isthmus, washed by the South Sea and Atlantic Ocean, Mexico appears destined to possess a powerful influence over the political events which agitate the two continents. A king of Spain resident in the capital might transmit his orders in five weeks to the Peninsula in Europe, and in six weeks to the Philippine islands in Asia. This vast empire, under a careful cultivation, would alone produce all that commerce collects together from the rest of the globe,—sugar, cochineal, cacao, cotton, coffee, wheat, hemp, flax, silk, oils, and wine. It would furnish every metal, without even the exception of mercury. The finest timber and an abundance of iron and copper might favour the progress of Mexican navigation, although the state of the coasts and the want of ports oppose obstacles in this respect which would be difficult to overcome.

Mexico is the most populous city of the new continent. It contains nearly 40,000 inhabitants less

than Madrid; and as it forms a great square of which each side is about 9,000 feet, its population is spread over a great extent of ground. The streets being very spacious, in general appear rather deserted. They are the less frequented, as, in a climate considered cold by the inhabitants of the tropics, people do not expose themselves so much to the open air, as in the cities at the foot of the Cordillera. Hence the latter *(ciudades de tierra caliente)* uniformly appear more populous than the cities of the temperate or cold regions *(ciudades de tierra fria)*.

Adorned with numerous teocallis*, like so many Mahometan steeples, surrounded with water and dikes, founded on islands covered with verdure, and receiving hourly in its streets thousands of boats, which animated the lake, the ancient Tenochtitlan, according to the accounts of the first conquerors, must have resembled some of the cities of Holland, China, or the Delta of Lower Egypt. The capital, reconstructed by the Spaniards, exhibits, perhaps, a less lively, though a more august and majestic appearance. Mexico is undoubtedly one of the finest cities ever built by Europeans in either hemisphere. With the exception of Petersburg, Berlin, Philadelphia, and some parts of Westminster, there does not exist a city of the same extent which can be compared to the capital of New Spain—for the uniform level of the ground on which it stands, for

* Houses of God.

the regularity and breadth of the streets, and the extent of the public places. The architecture is generally of a very pure style, and there are some edifices of very beautiful structure. The exterior of the houses is not loaded with ornaments. Two sorts of hewn stone, the porous amygdaloid called tetzontli, and especially a porphyry of vitreous feldspath without any quartz, give to the Mexican buildings an air of solidity, and sometimes even of magnificence. None of those wooden balconies and galleries are to be seen, which so much disfigure all the European cities in both Indies. The balustrades and gates are all of Biscay iron, ornamented with bronze; and the houses, instead of roofs, have terraces like those in Italy and other southern countries.

Mexico has been very much embellished since the residence of the Abbé Chappe there in 1769. The edifice destined to the School of Mines, for which the richest individuals of the country furnished a sum of more than 125,000*l.* sterling, would adorn the principal places of Paris or London. Two great palaces *(hotels)* were recently constructed by Mexican artists, pupils of the Academy of Fine Arts of the capital. One of these palaces, in the quarter *della Traspana*, exhibits in the interior of the court a very beautiful oval peristyle of clustered columns. The traveller admires a vast circumference paved with porphyry flags, and inclosed with an iron railing, richly ornamented with bronze,

containing an equestrian statue of King Charles the Fourth, placed on a pedestal of Mexican marble, in the midst of the *Plaza Major* of Mexico, opposite the cathedral and the viceroy's palace. It must however be allowed, that, notwithstanding the progress of the arts within these last thirty years, it is much less from the grandeur and beauty of the monuments, than from the breadth and straightness of the streets, and much less from its edifices, than from its uniform regularity, its extent and position, that the capital of New Spain attracts the admiration of Europeans. From a singular concurrence of circumstances, I have seen successively, within a very short space of time, Lima, Mexico, Philadelphia, Washington, Paris, Rome, Naples, and the largest cities of Germany. By comparing together impressions which follow in rapid succession, we are enabled to rectify any opinion which we may have too easily adopted. Notwithstanding these unavoidable comparisons, several of which, one would think, must have proved disadvantageous to the capital of Mexico, it has left in my mind a recollection of grandeur, which I principally attribute to the majestic character of its situation and the surrounding scenery.

Nothing, indeed, can present a more rich and varied appearance than the valley, when, in a fine summer morning, under a sky without a cloud, and of that deep azure which is peculiar to the dry and rarefied air of high mountains, we transport our-

selves to the top of one of the towers of the cathedral of Mexico, or ascend the hill of Chapoltepec. A beautiful vegetation surrounds this hill. Old cypress trunks, of more than 50 feet in circumference, raise their naked heads above those of the schinus, which resemble in their appearance the weeping-willows of the East. From the centre of this solitude, the summit of the porphyritical rock of Chapoltepec, the eye sweeps over a vast plain of carefully cultivated fields, which extend to the very feet of the colossal mountains covered with perpetual snow. The city appears as if washed by the waters of the lake of Tezcuco, whose basin, surrounded with villages and hamlets, brings to mind the most beautiful lakes of the mountains of Switzerland. Large avenues of elms and poplars lead in every direction to the capital; and two aqueducts, constructed over arches of very great elevation, cross the plain, and exhibit an appearance equally agreeable and interesting. The magnificent convent of Nuestra Señora de Guadalupe appears joined to the mountains of Tepeyacac, among ravines, which shelter a few date and young yucca trees. Towards the south, the whole tract between San Angel, Tacabaya, and San Augustin de las Cuevas, appears an immense garden of orange, peach, apple, cherry, and other European fruit-trees. This beautiful cultivation forms a singular contrast with the wild appearance of the naked mountains which inclose the valley, among which

the famous volcanos of La Puebla, Popocatepetl, and Iztaccihuatl are the most distinguished. The first of these forms an enormous cone, of which the crater, continually inflamed and throwing up smoke and ashes, opens in the midst of eternal snows.

The market of Mexico is richly supplied with eatables, particularly with roots and fruits of every sort. It is a most interesting spectacle, which may be enjoyed every morning at sun-rise, to see these provisions, and a profusion of flowers, brought in by Indians in boats descending the canals of Istacalco and Chalco. The greater part of these roots are cultivated on the *chinampas*, called by the Europeans floating gardens. There are two sorts of them, of which the one is moveable, and driven about by the winds, and the other fixed and attached to the shore. The first alone merit the denomination of floating gardens, but their number is daily diminishing.

The city of Mexico is also remarkable for its excellent police. Most of the streets have very broad pavements; and they are clean and well lighted. These advantages are the fruits of the activity of the Count de Revillagigedo, who on his arrival found the capital extremely dirty.

Water is every where to be had in the soil of Mexico a very short way below the surface, but it is brackish, like the water of the lake of Tezcuco. The two aqueducts already mentioned, by which the city receives fresh water, are monuments of modern

construction worthy of the traveller's attention. The springs of potable water are situated to the east of the town, one in the insulated hill of Chapoltepec, and the other in the cerros of Santa Fe, near the Cordillera which separates the valley of Tenochtitlan from that of Lerma and Toluca. The arches of the aqueduct of Chapoltepec occupy a length of near 11,000 feet. The water of Chapoltepec enters by the southern part of the city, at the *Salto del Agua*.

The valley of Tenochtitlan offers to the examination of naturalists two sources of mineral water, that of Nuestra Señora de Guadalupe, and that of the Peñon de los Baños. These sources contain carbonic acid, sulfate of lime and soda, and muriate of soda. Baths have been established there in a manner equally salutary and convenient. The Indians manufacture their salt near the Peñon de los Baños.

No city of the new continent, without even excepting those of the United States, can display such great and solid scientific establishments as the capital of Mexico. I shall content myself here with naming the School of Mines, directed by the learned Elhuyar, to which we shall return when we come to speak of the mines; the Botanic Garden; and the Academy of Painting and Sculpture. This academy bears the title of *Academia de las Nobles Artes de Mexico*.

The revenues of the Academy of Fine Arts at

Mexico amount to above 5,000*l.* sterling, of which the Government gives 3,000*l.*, the body of Mexican Miners 1,000*l.*, the *Consulado*, or association of merchants of the capital, 1,000*l.* It is impossible not to perceive the influence of this establishment on the taste of the nation. This influence is particularly visible in the symmetry of the buildings, in the perfection with which the hewing of stone is conducted, and in the ornaments of the capitals and stucco relievos. What a number of beautiful edifices are to be seen at Mexico! nay, even in provincial towns like Guanaxuato and Queretaro! These monuments, which frequently cost from 40,000*l.* to 60,000*l.* sterling, would appear to advantage in the finest streets of Paris, Berlin, and Petersburg. M. Tolsa, professor of sculpture at Mexico, has cast an equestrian statue of King Charles the Fourth, which, with the exception of the Marcus Aurelius at Rome, surpasses in beauty and purity of style every work of the kind in Europe. Instruction is communicated *gratis* at the Academy of Fine Arts. It is not confined alone to the drawing of landscapes and figures; they have had the good sense to employ other means for exciting the national industry. The academy labours successfully to introduce among the artisans a taste for elegance and beautiful forms. Large rooms well lighted by Argand's lamps, contain every evening some hundreds of young people, some of whom draw from relievo or

living models, while others copy drawings of furniture, chandeliers, or other ornaments in bronze. In this assemblage (and this is very remarkable in the midst of a country where the prejudices of the nobility against the castes are so inveterate) rank, colour and race are confounded: we see the Indian and the Mestizo sitting beside the White, and the son of a poor artisan entering into competition with the children of the great lords of the country. It is a consolation to observe, that under every zone the cultivation of science and art establishes a certain equality among men, and obliterates, for a time at least, all those petty passions of which the effects are so prejudicial to social happiness.

Since the close of the reign of Charles the Third, and under that of Charles the Fourth, the study of the physical sciences has made great progress, not only in Mexico, but in general in all the Spanish colonies.

The principles of the new chemistry, which is known in the Spanish colonies by the equivocal appellation of new philosophy, (*nueva filosofia*,) are more diffused in Mexico than in many parts of the peninsula. A European traveller is surprised to meet in the interior of the country, on the very borders of California, with young Mexicans who reason on the decomposition of water in the process of amalgamation with free air. The School of Mines possesses a chemical laboratory; a geological collection, arranged according to the system

of Werner; a physical cabinet, in which we not only find the valuable instruments of Ramsden, Adams, Le Noir, and Louis Berthoud, but also models executed in the capital, with the greatest precision, and from the finest wood in the country. The best mineralogical work in the Spanish language was printed at Mexico, I mean the Manual of Oryctognosy, composed by M. del Rio, according to the principles of the school of Freyberg, in which the author was formed. The first Spanish translation of Lavoisier's Elements of Chemistry was also published at Mexico. I cite these insulated facts, because they give us the measure of the ardour with which the exact sciences are beginning to be studied in the capital of New Spain. This ardour is much greater than that with which they addict themselves to the study of languages and ancient literature.

Instruction in mathematics is less carefully attended to in the university of Mexico than in the School of Mines. The pupils of this last establishment go further into analysis; they are instructed in the integral and differential calculi. On the return of peace and free intercourse with Europe, when astronomical instruments (chronometers, sextants, and the repeating circles of Borda) shall become more common, young men will be found in the most remote parts of the kingdom capable of making observations, and calculating them after the most recent methods.

Within these twenty years, the Spanish and Portuguese settlements of the New Continent have experienced considerable changes in their moral and political state; and the want of education and knowledge has begun to be felt with the increasing population and prosperity. The free trade with neutrals, which the Court of Madrid, yielding to imperious circumstances, has from time to time granted to the island of Cuba, the coast of Caracas, the ports of Vera Cruz and Monte Video, has brought the colonists into contact with the Anglo-Americans, the French, the English, and the Danes; the colonists have formed the most correct ideas respecting the state of Spain, compared with the other powers of Europe; and the American youth, sacrificing part of their national prejudices, have formed a marked predilection for those nations whose cultivation is further advanced than that of the European Spaniards. In these circumstances, we are not to be astonished, that the political movements which have taken place in Europe since 1789, have excited the liveliest interest among a people who have long been aspiring to rights, the privation of which is both an obstacle to the public prosperity, and a source of resentment against the Mother Country.

Mexico is the country of inequality. No where does there exist such a fearful difference in the distribution of fortune, civilization, cultivation of the soil, and population. The interior of the

country contains four cities, which are not more than one or two days' journey distant from one another, and possess a population of 35,000, 67,000, 70,000, and 135,000 souls. The central tableland from La Puebla to Mexico, and from thence to Salamanca and Zelaya, is covered with villages and hamlets like the most cultivated parts of Lombardy. To the east and west of this narrow strip succeed tracts of uncultivated ground, on which we scarcely find above one person to the square mile. The capital and several other cities have scientific establishments, which will bear a comparison with those of Europe. The architecture of the public and private edifices, the elegance of the furniture, the equipages, the luxury and dress of the women, the tone of society, all announce a refinement to which the nakedness, ignorance, and vulgarity of the lower people form the most striking contrast. This immense inequality of fortune does not only exist among the caste of Whites (Europeans or Creoles), it is even discoverable among the Indians.

If, in the present state of things, the caste of Whites is the only one in which we find any thing like intellectual cultivation, it is also the only one which possesses great wealth. This wealth is unfortunately still more unequally distributed in Mexico than in the *capitania general* of Caraccas, the Havannah, and especially Peru. At Caraccas, the heads of the richest families

possess an income of about 8,000*l.* In the Island of Cuba we find incomes of from 25,000*l.* to 30,000*l.* In these two industrious colonies agriculture has founded more considerable fortunes than have been accumulated by the working of the mines in Peru. At Lima an annual income of 30,000*l.* is very rare. I know in reality of no Peruvian family in the possession of a fixed and sure revenue of 50,000*l.* But in New Spain there are individuals who possess no mines, whose income amounts to 40,000*l.* The family of the Count de la Valenciana, for example, possesses alone, on the ridge of the Cordillera, a property worth more than a million sterling, without including the mine of Valenciana near Guanaxuato, which, *communibus annis*, yields a net revenue of 60,000*l.* This family, of which the present head, the young Count de la Valenciana, is distinguished for a generous character and a noble desire of instruction, is divided into only three branches; and they possess all together, even in years when the mine is not very lucrative, a revenue of more than 90,000*l.* The Count de *Regla*, whose youngest son, the Marquis de San Christobal*, distinguished himself at Paris for his physical and physiological knowledge, constructed at the Havannah, at his

* M. Terreros (this is the name by which this modest savant is known in France) preferred for a long time the instruction which his abode at Paris enabled him to procure, to the great fortune which he could only enjoy living in Mexico.

own expense, of acajou and cedar *(cedrella)* wood, two vessels of the line of the largest size, which he presented to his sovereign. It was the vein of la Biscaina, near Pachuca, which laid the foundation of the fortune of the house of Regla. The family of *Fagoaga*, well known for its beneficence, intelligence, and zeal for the public good, exhibits the example of the greatest wealth which was ever derived from a mine. A single vein which the family of the Marquis of Fagoaga possesses in the district of Sombrerete, left, in five or six months, all charges deducted, a net profit of upwards of 800,000*l.*

From these data one would suppose there existed capitals in the Mexican families infinitely greater than what are really observed. The deceased Count de la Valenciana, the first of the title, sometimes drew from his mine alone, in one year, a net revenue of no less than 250,000*l.* This annual income, during the last twenty-five years of his life, was never below from 80,000*l.* to 125,000*l.*; and yet this extraordinary man, who came without any fortune to America, and who continued to live with great simplicity, left behind him at his death, besides his mine, which is the richest in the world, in property and capital, only about 400,000*l.* This fact, which may be relied on, will not surprise those who are acquainted with the internal management of the great Mexican houses. Money rapidly gained is as rapidly spent. The working of mines

becomes a game, in which they embark with unbounded passion. The rich proprietors of mines lavish immense sums on quacks, who engage them in new undertakings in the most remote provinces. In a country where the works are conducted on such an extravagant scale, that the shaft of a mine frequently requires 80,000*l.* to pierce, the bad success of a rash project may, in a few years, absorb all that was gained in working the richest veins. We must add, that from the internal disorder which prevails in most of the great houses of both Old and New Spain, the head of a family is not unfrequently straitened with a revenue of 20,000*l.*, though he display no other luxury than that of numerous yokes of mules.

The mines have undoubtedly been the principal sources of the great fortunes of Mexico. Many miners have laid out their wealth in purchasing land, and have devoted themselves with great zeal to agriculture. But there is also a considerable number of powerful families who have never had the working of any very lucrative mines. Such are the rich descendants of Cortez, or the *Marquis del Valle*. The Duke of Monteleone, a Neapolitan nobleman, who is now the head of the house of Cortez, possesses magnificent estates in the province of Oaxaca, near Toluca, and at Cuernavaca. The net produce of his rents is now no more than 23,000*l.*, the king having deprived the duke of the collection of the *alcavalas* and the duties on tobacco.

The ordinary expenses of the management of his property amount to more than 5000*l.* per annum. Several governors of the *marquesado* have however become extremely wealthy. If the descendants of the great *conquistador* would only live in Mexico, their revenue would immediately rise to more than 60,000*l.*

As a further proof of the immense wealth centred in the hands of a few individuals in New Spain, which may compete with any thing in Great Britain, or the European possessions in Hindostan, I must mention the pecuniary sacrifices annually made by the body of Miners (*Cuerpo de mineria*) for the improvement of mining. This body, formed by a union of the proprietors of mines, and represented by deputies who sit in the *Tribunal de Mineria*, advanced in three years, between 1784 and 1787, more than 160,000*l.* to individuals who were in want of the necessary funds to carry on great works. It is believed in the country that this money has not been very usefully employed (*para habilitar*); but its distribution proves the generosity and opulence of those who are able to make such donations. A European reader will be still more astonished when I inform him of the extraordinary fact, that the respectable family of Fagoagas lent, a few years ago, without interest, nearly 150,000*l.* to a friend, whose fortune they believed would be permanently secured by it. This sum was irrevocably lost in an unsuccessful new mining undertaking. The archi-

tectural works which are carried on in the capital of Mexico for the embellishment of the city are so expensive, that, notwithstanding the low rate of wages, the superb edifice constructed by order of the *Tribunal de Mineria* for the School of Mines will cost at least 125,000*l.*, of which 80,000*l.* were in readiness before the foundation was laid. To hasten the construction, and particularly to furnish the students immediately with a proper laboratory for metallic experiments on the amalgamation of great masses of minerals (*beneficio de patio*), the body of Mexican Miners contributed monthly, in the year 1803 alone, the sum of 2000*l.* Such is the facility with which vast projects are executed in a country where wealth is divided among a small number of individuals.

CHAPTER III.

Climate—variety under the same latitude—rains—general salubrity—fertility of the soil—corn, fruits—cattle—general improvement in agriculture—influence of mines on agriculture—habits of Indian cultivators.

HAVING traced the physical outline of the country, and described the inequalities of its surface, we shall proceed to point out the effect of these inequalities upon its climate, and to give some account of the state of cultivation. We shall confine ourselves to a few general and important facts. Details of natural history do not fall within the compass or the purpose of this work; but it is impossible to form an exact idea of the territorial riches of a country without knowing the form of the mountains, the height of the great plains of the interior, and the temperature of the regions in which there are (if we may so express ourselves) successive strata of climate.

If we take a general view of the whole surface of the kingdom of Mexico, we shall see that two-thirds are situated under the temperate, and one under the torrid zone. The former part contains 738,000 square miles, and includes the *Provincias Internas de la Commendancia-general*, a district thinly

peopled. The latter, containing 324,000 square miles, enjoys a climate which is cool or temperate, rather than sultry. It is well known that the climate of a country depends, not only on its distance from the pole, but also on its elevation above the level of the sea, proximity to the ocean, configuration, and many other local circumstances. The interior of the viceroyalty of Mexico forms an immense plain, elevated from 6000 to 8200 feet above the level of the sea. The country lying between the capital of Mexico and the port of Vera Cruz may be divided into three districts or zones, the climate of which depends on their elevation. The first of these, called by the natives *terras calientes*, comprehends all the country on the coast, nearly the whole intendancy of Vera Cruz, the southern regions of the intendancies of Mexico, Valladolid, and La Puebla. It is all flat country, intersected by inconsiderable hills. The mean temperature of these plains is about 77° of Fahrenheit's thermometer, that is to say, 15° or 16° higher than the temperature of Naples. They produce sugar, indigo, cotton, and bananas, in abundance, but are extremely unhealthy. They are liable to great and sudden changes of temperature, and are frequently visited by yellow fever.

The next region, called *terras templadas*, lies on the declivity of the Cordilleras, at the height of from 4000 to 5000 feet, and enjoys a perpetual spring. The temperature is soft and equal, never varying

more than 4° or 5°: the mean heat of the whole year is from 68° to 70°. This region is, however, extremely liable to fogs from the sea.

The third zone, the *terras frias*, comprehends the table-lands, which are elevated more than 7200 feet above the level of the sea. Although they are known under the name of *terras frias*, the thermometer has very rarely been known to be down to the freezing point: in the coldest season the mean heat of the day is from 55° to 60°. In summer the thermometer in the shade does not rise above 75°. The general mean temperature of the whole vast table-land of Mexico is 62°. It is equal to the temperature of Rome. This is a sufficient proof that the words hot and cold have no positive value. The table-lands higher than that of Mexico have a very rough and disagreeable climate, even to the feelings of a native of a northern latitude. The winters are not severe, but there is a total absence of that transient summer which has a peculiar beauty in high latitudes.

These general considerations on the physical division of New Spain are extremely interesting in a political point of view. In France, and even in the greatest part of Europe, the cultivation of the soil depends almost entirely on geographical latitude; but in the equinoctial regions of Peru, New Grenada, and Mexico, the climate, productions, and aspect of the country, are solely modified by the elevation of the soil above the level

of the sea. The influence of geographical position is absorbed in the effect of this elevation.

There are only two seasons known in the equinoctial region of Mexico even as far as the 28th degree of N. latitude; the rainy season (*estacion de las aguas*), which begins in the month of June or July, and ends in the month of September or October, and the dry season (*el estio*), which lasts eight months, from October to the end of May. The first rains generally commence on the eastern declivity of the Cordillera. The formation of the clouds, and the precipitation of the water dissolved in the air, commence on the coast of Vera Cruz. These phenomena are accompanied with strong electrical explosions, which take place successively at Mexico, Guadalaxara, and on the western coast. The chemical action is propagated from east to west in the direction of the trade winds, and the rains begin fifteen or twenty days sooner at Vera Cruz than on the central table-land. Sometimes we see in the mountain, even below 6600 feet of absolute height, rain mixed with hail (*gresil*) and snow in the months of November, December, and January; but these rains are very short, and only last from four to five days; and, however cold they may be, they are considered as very beneficial to the wheat and pasture lands. In Mexico, as in Europe, the rains are most frequent in the mountainous regions, especially in that part of the Cordilleras which extends from the Pic d'Orizaba by Guanaxuato,

Sierra de Pinos, Zacatecas, and Bolaños, to the mines of Guarisamey and the Rosario.

To the north of 20°, from the 22d to the 30th degree of latitude, the rains, which fall only in the months of June, July, August, and September, are very unfrequent in the interior of the country.

The aridity of the central plain, the want of trees, occasioned, perhaps, in a good measure by the length of time the great valleys have remained covered with water, obstruct very much the working of the mines. These disadvantages have augmented since the arrival of Europeans in Mexico, who have not only destroyed without planting, but in draining great tracts of land have occasioned another more important evil. Muriate of soda and lime, nitrate of potash, and other saline substances, cover the surface of the soil, and spread with a rapidity very difficult to be explained. Through this abundance of salt, and these efflorescences, hostile to cultivation, the table-land of Mexico bears a great resemblance in many places to Thibet and the saline steppes of central Asia. In the valley of Tenochtitlan particularly, the sterility and want of vigorous vegetation have been sensibly augmenting since the Spanish conquest; for this valley was adorned with beautiful verdure when the lake occupied more ground, and the clayey soil was washed by more frequent inundations.

Happily, however, this aridity of soil, of which we have been indicating the principal physical causes,

is only to be found in the most elevated plains. A great part of the vast kingdom of New Spain may be ranked among the most fertile regions of the earth. The declivity of the Cordillera is exposed to humid winds and frequent fogs; and the vegetation nourished by these aqueous vapours exhibits an uncommon beauty and strength. The humidity of the coasts, assisting the putrefaction of a great mass of organic substances, gives rise to maladies, to which Europeans and others not seasoned to the climate are alone exposed; for under the burning sun of the tropics the unhealthiness of the air almost always indicates extraordinary fertility of soil. Thus at Vera Cruz the quantity of rain in a year amounts to 63 inches, while in France it scarcely amounts to 31 inches. Yet with the exception of a few sea-ports and deep valleys, where the natives suffer from intermittent fevers, New Spain must be considered as a remarkably healthy country.

In hot but dry climates the human species enjoys a longevity perhaps greater than what we observe in the temperate zones. This is especially the case whenever the temperature and climate are very variable. The Europeans who settle in the equinoctial part of the Spanish colonies at an advanced period of life, generally live and enjoy health to a great age. At Vera Cruz, in the midst of the epidemical *black vomit*, the natives and strangers seasoned for several years to the climate enjoy the most perfect health.

In general, the coasts and arid plains of equato-

rial America, must be regarded as healthy, notwithstanding the excessive heat of the sun, whose perpendicular rays are reflected by the soil. Individuals arrived at maturity, particularly those who approach to old age, have little to fear from these regions, the unhealthiness of which has been unjustifiably exaggerated. The chief mortality is among the children and young people, particularly in those parts where the climate is at once hot and moist.

The inhabitants of Mexico are less disturbed by earthquakes and volcanic eruptions than those of Quito and the provinces of Guatimala and Cumana. There are only five burning volcanoes in all New Spain, Orizaba, Popocatepetl, and the mountains of Tustla, Jorullo, and Colima. Earthquakes, however, are by no means rare on the coast of the Pacific Ocean, and in the environs of the capital, but they never produce such desolating effects as have been experienced in the more southern provinces.

A very serious inconvenience is common to the eastern coast, and to the coast washed by the great ocean falsely called the Pacific Ocean. They are rendered inaccessible for several months by violent tempests, which effectually prevent all navigation. The north-west winds (*los nortes*) blow in the Gulf of Mexico from the autumnal to the spring equinox. These winds are generally moderate in the months of September and October; their greatest fury is in the month of March, and they sometimes last into April. Navigators who have long frequented the port of Vera

Cruz, know the symptoms which always foretell the approach of the tempest.

An empire extending from the sixteenth to the thirty-seventh degree of latitude affords us, from its geometrical position, all the modifications of climate to be found on transporting ourselves from the banks of the Senegal to Spain, or from the Malabar coast to the steppes of the Great Bucharia. This variety of climate is also augmented by the geological constitution of the country, by the mass and extraordinary form of the Mexican mountains, which we have already described. On the ridge and declivity of the Cordilleras the temperature of each table-land varies as it is more or less elevated; not merely insulated peaks, the summits of which approach the region of perpetual snow, are covered with oaks and pines, but whole provinces spontaneously produce alpine plants; and the cultivator inhabiting the torrid zone frequently loses the hopes of his harvest from the effects of frost or from the abundance of snow.

Geographical position alone does not determine the nature of the productions of these fine regions. The union of several physical causes alluded to above, gives to a part of the equinoctial regions a temperature adapted to the cultivation of the wheat and fruit-trees of Europe. Latitude has small influence on the fertility of a country, where, on the summit and declivity of the mountains, nature exhibits an union of every climate.

We may conceive that, in a country like Mexico, the variety of indigenous productions must be immense, and that there hardly exists a plant on the rest of the globe which is not capable of being cultivated in some part of New Spain.

In general, in the equinoctial regions of New Spain, the soil, climate, physiognomy of vegetables, all assume the character of the temperate zones.

The riches of the harvests are surprising in lands carefully cultivated, especially in those which are watered, or properly separated by different courses of labour. The most fertile part of the table-land is that which extends from Queretaro to the town of Leon. These elevated plains are 90 miles in length by 20 or 30 in breadth. The wheat harvest is 35 and 40 for 1, and several great farms can even reckon on 50 or 60 to 1. I found the same fertility in the fields which extend from the village of Santiago to Yurirapundaro in the intendancy of Valladolid. In the environs of Puebla, Atlisco, and Zelaya, in a great part of the bishopricks of Michoacan and Guadalaxara, the produce is from 20 to 30 for 1. A field is considered there as far from fertile when a fanega* of wheat yields only, *communibus annis*, 16 fanegas. At Cholula the common harvest is from 30 to 40, but it frequently exceeds from 70 to 80 for 1. In the valley of Mexico the maize yields 200 and the wheat 18 or 20.

* About a hundred weight.

In good years the kingdom of New Spain produces much more maize than it can consume. As the country unites in a small space a great variety of climates, and as maize rarely succeeds at the same time in the warm region (*tierras calientas*) and on the central table-land in the *terras frias*, the interior commerce is greatly animated by the transport of this grain. Maize compared with European grain has the disadvantage of containing a smaller quantity of nutritive substance in a greater volume. This circumstance, and the difficulty of the roads on the declivities of the mountains, present obstacles to its exportation, which will be in a great degree removed by the construction of the fine causeway from Vera Cruz to Xalapa and Perote.

The Mexican wheat is of the very best quality; it may be compared with the finest Andalusian grain. The grain is very large, white, and nutritive, especially in farms where watering is employed.

The interior of New Spain is infinitely productive in nutritive gramina, wherever the industry of man has corrected the natural dryness of the soil and the air. No where does the proprietor of a large farm more frequently feel the necessity of employing engineers skilled in surveying ground and in the principles of hydraulic constructions. At Mexico however, as elsewhere, those arts which please the imagination have been preferred to those which are indispensable to the wants of domestic life. They possess architects, who judge scientifically of the beauty

and symmetry of an edifice; but nothing is still so rare there, as to find persons capable of constructing machines, dikes, and canals. Fortunately, the feeling of their want has excited the national industry; and a certian sagacity peculiar to all mountainous people supplies in some degree the want of instruction.

Mexico is extremely rich in vegetables with nutritive roots. The plants which are cultivated in the highest and coldest part of the Andes and Mexican Cordilleras are the potatoe, the *tropæolum esculentum*, and the *chenopodium quinoa*, the grain of which is an aliment equally agreeable and healthy. In New Spain the first of these becomes an object of cultivation, of so much the greater importance and extent, as it does not require any great humidity of soil. The Mexicans, like the Peruvians, can preserve potatoes for years by exposing them to the frost and drying them in the sun.

The Mexicans now possess all the garden-stuffs and fruit-trees of Europe. The central table-land of New Spain produces in the greatest abundance cherries, plums, peaches, apricots, figs, grapes, melons, apples, and pears. In the environs of Mexico, the villages of San Augustin de las Cuevas and Tacubaya, the famous garden of the Convent of Carmelites at San Angel, and that of the family of Fagoaga at Tanepantla, yield in the months of June, July, and August, an immense quantity of fruit, for the most part of an exquisite taste, although

the trees are in general very ill taken care of. The traveller is astonished to see in Mexico, Peru, and New Grenada, the tables of the wealthy inhabitants loaded at once with the fruits of temperate Europe, ananas, different species of *passiflora* and *tacsonia*, sapotes, mameis, goyavas, anonas, chilimoyas, and other valuable productions of the torrid zone.

There is a great abundance of horned cattle all along the eastern coast of Mexico, especially at the mouths of the rivers of Alvarado, Guasacualco, and Panuco, where numerous flocks feed on pastures of perpetual verdure. Since the middle of the sixteenth century, the most useful animals of the old continent, oxen, horses, sheep, and hogs, have multiplied surprisingly in all parts of New Spain, and especially in the vast plains of the *Provincias Internas*.

The horses of the northern provinces, and particularly those of New Mexico, are as celebrated for their excellent qualities as the horses of Chili; both descend, as it is pretended, from the Arab race; they wander wild in herds, in the savannahs of the *Provincias Internas*. The exportation of these horses to Natchez and New Orleans, becomes every year of greater importance. Many Mexican families possess in their *Hatos de ganado*, from thirty to forty thousand head of horses and oxen. The mules would be still more numerous, if so many of them did not perish on the highways from the excessive fatigues of journeys of several months. It is reckoned that the commerce of Vera Cruz

alone, employs annually nearly 70,000 mules. More than 5,000 are employed for purposes of luxury in the carriages of the city of Mexico.

The cultivation of the soil, notwithstanding the fetters with which it is every where shackled, has lately made a more considerable progress, on account of the immense capitals laid out in land, by families enriched either by the commerce of Vera Cruz and Acapulco, or by the working of the mines.

Those who only know the interior of the Spanish colonies from the vague and uncertain notions hitherto published, will have some difficulty in believing that the principal sources of the Mexican riches are by no means the mines, but an agriculture which has been gradually ameliorating since the end of the last century. Without reflecting on the immense extent of the country, and especially the great number of provinces which appear totally destitute of precious metals, we generally imagine that all the activity of the Mexican population is directed to the working of mines.

The best cultivated fields of Mexico, those which recall to the mind of the traveller the beautiful plains of France, are those which extend from Salamanca towards Silao, Guanaxuato, and the Villa de Leon, and which surround the richest mines of the known world. Wherever metallic veins have been discovered in the most uncultivated parts of the Cordilleras, on the insulated and desert table-

lands, the working of mines, far from impeding the cultivation of the soil, as it is generally imagined, has been singularly favourable to it. Travelling along the ridge of the Andes, or the mountainous part of Mexico, we every where see the most striking examples of the beneficial influence of the mines on agriculture. Were it not for the establishments formed for the working of the mines, how many places would have remained desert! how many districts uncultivated in the four intendancies of Guanaxuato, Zacatecas, San Luis Potosi, and Durango, between the parallels of 21° and 25°, where the most considerable metallic wealth of New Spain is to be found! If the town is placed on the arid side or the crest of the Cordilleras, the new colonists can only draw from a distance means for their subsistence, and for the maintenance of the great number of cattle employed in drawing off the water, and raising and amalgamating the mineral produce. Want soon awakens industry. The soil begins to be cultivated in the ravines and declivities of the neighbouring mountains, wherever the rock is covered with earth. Farms are established in the neighbourhood of the mine. The high price of provision, from the competition of the purchasers, indemnifies the cultivator for the privations to which he is exposed from the hard life of the mountains. Thus from the hope of gain, and the motives of mutual interest, —the most powerful bonds of society,—and with-

out any interference on the part of the Government to promote colonization, a mine which at first appeared insulated in the midst of wild and desert mountains, becomes in a short time connected with the lands which have long been under cultivation.

Moreover, this influence of the mines on the progressive cultivation of the country is more durable than they are themselves. When the veins are exhausted, and the subterraneous operations are abandoned, the population of the canton undoubtedly diminishes, because the miners emigrate elsewhere; but the colonist is retained by his attachment for the spot where he received his birth, and which his fathers cultivated with their hands. The more lonely the cottage is, the more charms has it for the inhabitant of the mountains. It is with the beginning of civilization as with its decline: man appears to repent of the constraint which he has imposed on himself by entering into society; and he loves solitude because it restores to him his former freedom. This desire for solitude is particularly manifested by the copper-coloured natives, whom a long and sad experience has disgusted with social life, and more especially with the neighbourhood of the Whites. Like the Arcadians, the Aztec people love to inhabit the summits and brows of the steepest mountains. This peculiar trait in their disposition contributes very much to extend population in the mountainous regions of Mexico.

What a pleasure is it for the traveller to follow these peaceful conquests of agriculture, to contemplate the numerous Indian cottages dispersed in the wildest ravines, and necks of cultivated ground advancing into a desert country between naked and arid rocks!

The Indian cultivator is poor, but he is free. His state is even greatly preferable to that of the peasantry in a great part of the north of Europe. There are neither *corvées* nor villenage in New Spain; and the number of slaves is next to nothing. Sugar is chiefly the produce of free hands. There the principal objects of agriculture are not the productions to which European luxury has assigned a variable and arbitrary value, but cereal gramina, nutritive roots, and the agave, the vine of the Indians. The appearance of the country proclaims to the traveller that the soil nourishes him who cultivates it, and that the true prosperity of the Mexican people neither depends on the accidents of foreign commerce, nor on the unsettled politics of Europe.

We have thus examined the true national wealth of Mexico; for the produce of the earth is, in fact, the sole basis of permanent opulence. It is consolatory to see that the labour of man, for half a century, has been more directed towards this fertile and inexhaustible source, than towards the working of mines, of which the wealth has not so direct an influence on the public prosperity, and

merely changes the nominal value of the annual produce of the earth. The territorial impost levied by the clergy, under the name of tenth, or tithe, measures the quantity of that produce, and indicates with precision the progress of agricultural industry, if we compare the periods, in the interval of which the price of commodities has undergone no sensible variation.

The result of such a comparison made from the most exact data is, that the total augmentation has been, in the last ten years, 1,062,500*l.*, or two-fifths of the total produce. The same data also indicate the rapidity of the progress of agriculture, in the intendancies of Mexico, Guadalaxara, Puebla, and Valladolid, compared with the provinces of Oaxaca and New Biscay. The tithes have been nearly doubled in the archbishoprick of Mexico; for those which were levied during the ten years anterior to 1780, were to those levied ten years afterwards in the proportion of 10 to 17. In the intendancy of Durango or New Biscay, this augmentation has been only in the proportion of 10 to 11.

CHAPTER IV.

Population—numbers and character of native Indians—comparison between the population of Mexico and that of the United States—small number of Negro slaves—increase of population—census of 1794.

The Mexican population is composed of the same elements as the other Spanish colonies. They reckon seven races: 1. The individuals born in Europe, vulgarly called *Gachupines*; 2. The Spanish Creoles, or Whites of European extraction born in America; 3. the *Mestizos*, descendants of Whites and Indians; 4. the Mulattos, descendants of Whites and Negros; 5. the *Zambos*, descendants of Negros and Indians; 6. the Indians, or copper-coloured indigenous race; and 7. the African Negros. Abstracting the subdivisions, there are four castes: the Whites comprehended under the general name of Spaniards, the Negros, the Indians, and the men of mixed extraction from Europeans, Africans, American Indians, and Malays; for from the frequent communication between Acapulco and the Philippine islands, many individuals of Asiatic origin, both Chinese and Malays, have settled in New Spain.

A very general prejudice exists in Europe, that an exceeding small number of the copper-coloured race, or descendants of the ancient Mexicans, re-

main at this day. The cruelty of the Europeans has entirely extirpated the old inhabitants of the West Indies; the continent of America, however, has witnessed no such horrible result. The number of Indians in New Spain exceeds two millions and a half, including those only who have no mixture of European or African blood. It is still more consolatory, that the indigenous population, far from declining, has been considerably on the increase for the last fifty years, as is proved by the registers of capitation or tribute.

The Indians appear to form two-fifths of the whole population of Mexico. In the four intendancies of Guanaxuato, Valladolid, Oaxaca, and La Puebla, this population amounts even to three-fifths. The census of 1793 gave the following result.

Names of intendancies.	*Total population.*	*Number of Indians.*
Guanaxuato .	398,000 .	175,000
Valladolid . .	290,000 .	119,000
Puebla . . .	638,000 .	416,000
Oaxaca . . .	411,000 .	363,000

To give an accurate idea of the indigenous inhabitants of New Spain, it is not enough to paint them in their present state of degradation and misery; we must go back to a remote period, when, governed by its own laws, the nation could display its native energy; and we must consult the hiero-

glyphical paintings, buildings of hewn stone, and works of sculpture still in preservation, which though they attest the infancy of the arts, yet bear a striking analogy to several monuments of the most civilized people. The nature of this work does not permit us to enter into such details, however interesting they may be, both for the history and the psychological study of our species. We shall merely point out here a few of the most prominent features of the immense picture of American indigenous population.

The Indians of New Spain bear a general resemblance to those who inhabit Canada, Florida, Peru, and Brasil. They have the same swarthy and copper colour, flat and smooth hair, small beard, squat body, long eye, with the corner directed upwards towards the temples, prominent cheek bones, thick lips, and an expression of gentleness in the mouth, strongly contrasted with a gloomy and severe expression of eye. The American race, after the hyperborean race, is the least numerous; but it occupies the greatest space on the globe.

Intellectual cultivation is what contributes the most to diversify the features. In barbarous nations there is rather a physiognomy peculiar to the tribe or horde, than to any individual. When we compare our domestic animals with those which inhabit our forests, we make the same observation. But an European, when he decides on the strong resemblance among the copper-coloured races, is

subject to a particular illusion. He is struck with a complexion so different from our own, and the uniformity of this complexion conceals for a long time from him the diversity of individual features. The new colonist at first can hardly distinguish the natives, because his eyes are less fixed on the gentle, melancholy, or ferocious expression of the countenance, than on the red coppery colour, and black coarse hair, so straight and glossy that it always appears wet.

As to the moral faculties of the Indians, it is difficult to appreciate them with justice, if we only consider this long oppressed caste in their present state of degradation. The better sort of Indians, among whom a certain degree of intellectual culture might be expected, perished in great numbers, at the commencement of the Spanish conquest, the victims of European ferocity. The Christian fanaticism was particularly directed against the Aztec priests; and the Teopixqui, or ministers of the divinity, and all those who inhabited the Teocalli, or houses of God, who might be considered as the depositories of the historical, mythological, and astronomical knowledge of the country, were exterminated; the priests observed the meridian shades in the gnomons, and regulated the calendar. The monks burned the hieroglyphical paintings, by which every kind of knowledge was transmitted from generation to generation. The people, deprived of these means of instruction, were plunged

in an ignorance so much the deeper, as the Missionaries were unskilled in the Mexican languages, and could substitute few new ideas in the place of the old. The remaining natives then consisted only of the most indigent race, poor cultivators, artisans, among whom were a great number of weavers, porters, who were used like beasts of burden, and especially of those dregs of the people, those crowds of beggars, who bore witness to the imperfection of the social institutions, and the existence of feudal oppression, and who filled, in the time of Cortez, the streets of all the great cities of the Mexican empire. How shall we judge, then, from these miserable remains of a powerful people, of the degree of cultivation to which it had risen from the twelfth to the sixteenth century, and of the intellectual development of which it is susceptible? If all that remained of the French or German nation were a few poor agriculturists, could we read in their features that they belonged to nations which had produced a Descartes and Clairaut, a Kepler and a Leibnitz?

How is it possible to doubt that a part of the Mexican nation had arrived at a certain degree of cultivation, when we reflect on the care with which their hieroglyphical books were composed, and when we recollect that a citizen of Tlascala, in the midst of the tumults of war, took advantage of the facility offered him by our Roman alphabet to write in his own language five large volumes on the

history of a country of which he deplored the subjection?

In the portrait which we draw of the different races of men composing the population of New Spain, we shall merely consider the Mexican Indian in his actual state. We perceive in him neither that mobility of sensation, gesture, or feature, nor that activity of mind, for which several nations of the equinoctial regions of Africa are so advantageously distinguished. There cannot exist a more marked contrast than that between the impetuous vivacity of the Congo Negro, and the apparent phlegm of the Indian. From a feeling of this contrast, the Indian women not only prefer the Negros to the men of their own race, but also to the Europeans. The Mexican Indian is grave, melancholy, and silent, so long as he is not under the influence of intoxicating liquors. This gravity is peculiarly remarkable in Indian children, who at the age of four or five display much more intelligence and maturity than White children. The Mexican loves to throw a mysterious air over the most indifferent actions. The most violent passions are never painted in his features; and there is something frightful in seeing him pass all at once from absolute repose to a state of violent and unrestrained agitation. The Peruvian Indian possesses more gentleness of manners; the energy of the Mexican degenerates into harshness. These differences may have their origin in the different

religions and different governments of the two countries in former times. This energy is displayed particularly by the inhabitants of Tlascala. In the midst of their present degradation, the descendants of the citizens of that republic are still to be distinguished by a certain haughtiness of character, inspired by the memory of their former grandeur.

The Americans, like the Hindoos and other nations who have long groaned under a civil and military despotism, adhere to their customs, manners, and opinions, with extraordinary obstinacy*. I say opinions; for the introduction of Christianity has produced little other effect on the Indians of

* It is of the utmost importance to the prosperity and security of the great undertaking which now occupies so large a share of the public attention, that all the Officers and Servants sent out by the Mining Companies of England should observe the most inviolable respect for the religious opinions and institutions of the natives. The Protestant opinions of Englishmen are sufficiently obnoxious, without being called into notice by any injudicious and absurd and fruitless attempts at conversion. How totally these attempts have failed to produce any thing but disgust among the Hindoos, to whom the Baron de Humboldt here compares the Mexican Indians, is well known to every calm and well-informed man in our Eastern possessions.

If the utility and policy of agitating such a source of discord, where we are undisputed masters, may be questioned, we presume it will be admitted by all but fanatics, that it would be little short of insanity to do it in a country where our establishments will stand in need of the countenance and protection of all classes. We have pressed this subject the more warmly

Mexico than to substitute new ceremonies, the symbols of a gentle and humane religion, to the ceremonies of a sanguinary worship. This change from old to new rites was the effect of constraint, and not of persuasion, and was produced by political events alone. In the new continent, as well as in the old, half-civilized nations were accustomed to receive from the hands of the conqueror new laws and new divinities; and the vanquished Indian gods appeared to them to yield to the gods of the strangers.

Accustomed to a long slavery, as well under the domination of their own sovereigns as under that of the first conquerors, the natives of Mexico patiently suffer the vexations to which they are frequently exposed from the Whites. They oppose to them only cunning, veiled under the most deceitful appearances of apathy and stupidity. As the Indian can very rarely revenge himself on the Spaniards, he delights in making common cause with them for the oppression of his own fellow citizens. Oppressed for ages, and compelled to a blind obedience, he wishes to tyrannize in his turn. The Indian villages are governed by magistrates of

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upon our readers, as we know that among many of the inferior Officers, the motive to the course of action so earnestly deprecated will be found in peculiar force. However we may respect the disinterestedness of this motive, we are bound to repeat, that the safety of our establishments is absolutely dependant on caution and forbearance on this point.

the copper-coloured race; and an Indian alcade exercises his power with so much the greater severity, because he is sure of being supported by the priest or the *Spanish subdelegado*. Oppression produces every where the same effects; it every where corrupts the morals.

As the Indians almost all of them belong to the class of peasantry and labourers, it is not easy to judge of their aptitude for the arts which embellish life. I know no race of men who appear more destitute of imagination. When an Indian attains a certain degree of civilization, he displays a great facility of apprehension, a judicious mind, a natural logic, and a particular disposition to subtilize or seize the finest differences in the comparison of objects. He reasons coolly and methodically; but he never manifests that versatility of imagination, that glow of sentiment, and that creative and animating spirit, which characterize the nations of the south of Europe, and several tribes of African Negros. I deliver this opinion, however, with great diffidence. We cannot be too circumspect, in pronouncing on the moral or intellectual dispositions of nations from which we are separated by the multiplied obstacles resulting from a difference in language, and in manners and customs.

The Indians of New Spain, those at least subject to the European domination, generally attain to a pretty advanced age. As peaceable cultivators, and inhabitants of villages, they are not ex-

posed to the accidents attending the wandering life of the hunters and warriors of the Mississippi and the savannas of the Rio Gila. Accustomed to uniform nourishment of an almost entirely vegetable nature, that of their maize and cereal gramina, the Indians would undoubtedly attain very great longevity if their constitutions were not weakened by drunkenness. Their intoxicating liquors are rum, a fermentation of maize and the root of the jatropha, and especially the wine of the country, made of the juice of the agave americana, called *pulque*. This last liquor is nutritive, on account of the undecomposed sugar which it contains. Many Indians addicted to *pulque* take, for a long time, very little solid nourishment. When used with moderation it is very salutary, and, by fortifying the stomach, assists the functions of the gastric system.

The vice of drunkenness is, however, less general among the Indians than is generally believed. There are several Indian tribes very sober, whose fermented beverages are too weak to intoxicate. In New Spain drunkenness is most common among the Indians who inhabit the valley of Mexico, and the environs of Puebla and Tlascala, wherever the maguey or agave is cultivated on a great scale. The police in the city of Mexico sends round tumbrils, to collect the drunkards to be found stretched out in the streets. These Indians, who are treated like dead bodies, are carried to the

principal guard-house. In the morning an iron ring is put round their ancles, and they are made to clear the streets for three days. On letting them go on the fourth day, they are sure to find several of them in the course of the week. It is to be hoped that this evil will diminish, as civilization advances.

We are tempted to compare together the extent and population of Mexico, and that of two empires with which this fine colony is in relations of union and of rivalry. Spain is five times smaller than Mexico. Should no unforeseen misfortunes occur, we may reckon that in less than a century the population of New Spain will equal that of the mother country. The United States of North America since the cession of Louisiana, and since they recognise no other boundary than the *Rio-Bravo del Norte*, contain 2,160,000 square miles. Their population is not much greater than that of Mexico, as we shall see on examining the population and the area of New Spain.

If the political force of two states depended solely on the space which they occupy on the globe, and on the number of their inhabitants; if the nature of the soil, the configuration of the coast, and if the climate, the energy of the nation, and above all the degree of perfection of its social institutions, were not the principal elements of this grand dynamical calculation, the kingdom of New

Spain might now be placed in competition with the confederation of the American republics. Both labour under the inconvenience of an unequally distributed population; but that of the United States, though in a soil and climate less favoured by nature, augments with an infinitely greater rapidity. Neither does it comprehend, like the Mexican population, nearly two millions and a half of aborigines, degraded by the despotism of their ancient *Aztec* sovereigns, and by the vexations of the first conquerors. The kingdom of New Spain has, however, one decided advantage over the United States. The number of slaves there, either of African or of mixed race, is almost nothing; an advantage which the European colonists have only begun rightly to appreciate since the tragical events of the revolution of St. Domingo.

The kingdom of New Spain is, of all the European colonies under the torrid zone, that in which there are the fewest Negros. We may almost say that there are no slaves. We may go through the whole city of Mexico without seeing a black countenance. The service of no house is carried on by slaves. In this point of view especially, Mexico presents a singular contrast to the Havannah, Lima, and Caraccas. From exact information procured by those employed in the enumeration of 1793, it appears that in all New Spain there are not six thousand Negros, and not more than

MEXICO
THE TWO REPUBLICS

nine or ten thousand slaves, of whom the greatest number belong to the ports of Acapulco and Vera Cruz, or the warm regions of the coasts *(tierras calientes)*.

The slaves, who fortunately are in very small numbers in Mexico, are there, as in all the other Spanish possessions, somewhat more under the protection of the laws than the Negros of the other European colonies. These laws are always interpreted in favour of liberty. The Government wishes to see the number of freemen increased. A slave, who by his industry has procured a little money, may compel his master to give him his liberty on paying the moderate sum of 60*l.* or 80*l.* Liberty cannot be refused to a Negro on the pretext that he cost triple that sum, or that he possesses a peculiar talent for some lucrative employment. A slave who has been cruelly treated acquires, on that account, his freedom by the law, if the judge do justice to the cause of the oppressed; but it may be easily conceived that this beneficent law is frequently eluded.

Politico-economical investigations have been so rare in Spain, that it excites no surprise that the archives of the viceroyalty of Mexico contain no census of the population before 1794, when the Count of Villagegido, one of the wisest and most active of administrators, had resolution enough to undertake it. Those who know the difficulty of obtaining an exact census in the most cultivated

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countries of Europe, will easily imagine what powerful obstacles opposed themselves to his researches. He was indeed unable to terminate his undertaking.

The following is however a statement of the population of New Spain, from the notices transmitted by the intendants and governors of provinces to the viceroy, previous to the 12th May, 1794:

Names of the intendancies and governments in which the enumeration was completed in 1793.	POPULATION Of the intendancies and governments.	Of the capitals.
Mexico	1,162,886	112,926
Puebla	566,443	52,717
Tlascala	59,177	3,357
Oaxaca	411,366	19,069
Valladolid	289,314	17,093
Guanaxuato	397,924	32,098
San Luis Potosi	242,280	8,571
Zacatecas	118,027	25,495
Durango	122,806	11,027
Sonora	93,396	
Nuevo Mexico	30,953	
The two Californias	12,666	
Yucatan	358,261	28,392
Total population of New Spain deduced from the census of 1793	3,865,529	
In a Report to the King, Count de Revillagigedo estimated the intendancy of Guadalaxara at 485,000 Inhabitants. Intendancy of Vera Cruz at 120,000 Province of Cohahuila at 13,000	618,000	
Approximative result of the enumeration in 1793	4,483,529	inhabitants.

The viceroys who succeeded to the Count de Revillagigedo have never renewed the enumeration;

and since that time the Government has paid very little attention to statistical researches. Several memoirs, drawn up by intendants on the actual state of the country confided to their care, contain exactly the same numbers as the table of 1793, as if the population could have remained the same for ten years. It is certain, however, that this population has made the most extraordinary progress. The augmentation of tithes and of the Indian capitation, and of all the duties on consumption, the progress of agriculture and civilization, the aspect of a country covered with newly constructed houses, announce a rapid increase in every part of the kingdom.

The only true sign of a real and permanent increase of population, is an increase in the means of subsistence. This increase, this augmentation of the produce of agriculture, is evident in Mexico; and appears even to indicate a much more rapid progress of population than has been supposed, in deducing the population of 1803 from the imperfect census of 1793. In a catholic country, the ecclesiastical tithes are, as it were, the thermometer by which we may judge of the state of agriculture; and these tithes have doubled in less than 24 years.

In speaking of the progress of the Mexican population, we must briefly advert to its supposed increase by the arrival of European colonists, and to its diminution by the yellow fever or *black vomit*. It is sufficient to observe that Europe does

not send more than 800 annually to Mexico. Political writers have always exaggerated what they call the depopulation of the old continent by the new. M. Page, for instance, asserts in his work on the Commerce of St. Domingo, that the emigrations from Europe supply annually more than 100,000 individuals to the United States. This estimate is twenty times higher than the truth; for in 1784 and 1792, when the United States received the greatest number of European colonists, their number did not exceed 5000. The progress of population in Mexico and North America is derived solely from an increase of internal prosperity. As for the *vomito prieto*, it is never felt but on the coast, nor does it carry off annually more than from two to three thousand persons.

CHAPTER V.

Manufactures—powder manufactory—goldsmiths—mint—interior commerce—foreign commerce—smuggling—average value of exports and imports.

If we consider the small progress of manufactures in Spain, notwithstanding the numerous encouragements which they have received, since the Ministry of the Marquis de la Ensenada, we shall not be surprised that whatever relates to manufactures and manufacturing industry is still less advanced in Mexico. The restless and suspicious policy of the nations of Europe, the legislation and colonial policy of the moderns, which bear very little resemblance to those of the Phœnicians and Greeks, have thrown insurmountable obstacles in the way of the prosperity of their distant possessions.

Notwithstandig all these obstacles, the manufactures have made some progress in three centuries, during which time Biscayans, Catalonians, Asturians, and Valencians, have settled in the New World, and carried there the industry of their native provinces. The manufacture of coarse stuffs can every where be carried on at a low rate, when raw materials are found in abundance, and when the price of the goods of Europe and Oriental Asia is so much increased by carriage. In time of war,

the want of communication with the mother country, and the regulations prohibiting commerce with neutrals, have favoured the establishment of manufactures of calicoes, fine cloth, and whatever is connected with the refinements of luxury.

The value of the produce of the manufacturing industry of New Spain is estimated at about 1,600,000*l.* per annum. From the quantity and quality of the cotton which the low-lands of New Spain are so well adapted to produce, native manufactures of that material appear to hold the first place in importance. Those of the intendancy of Puebla furnish annually, in time of peace, for the interior commerce, a produce to the value of 325,000*l.* The weavers of cottons of all sorts in Puebla were computed in 1802 at more than 1200. In this town, as well as in Mexico, the printing of calicoes, both those imported from Manilla and those manufactured in New Spain, has made considerable progress within these few years.

The oldest cloth manufactories of Mexico are those of Tezcuco. They were in great part established in 1592 by the viceroy Don Louis de Velasco II., the son of the celebrated constable of Castille, who was second viceroy of New Spain. By degrees, this branch of national industry passed entirely into the hands of the Indians and Mestizoes. The value of the cloths and woollen stuffs manufactured in Queretaro at present amounts to more than 135,000*l.*

With the exception of a few stuffs of cotton mixed with silk, the manufacture of silks is at present next to nothing.

New Spain has no flax or hemp manufactories, and the manufacture of paper is also unknown in it. The manufacture of tobacco is a royal right.

The manufacture of hard soap is a considerable object of commerce at Puebla, Mexico, and Guadalaxara. The first of these towns produces nearly 2143 tons per annum; and in the intendancy of Guadalaxara, the quantity manufactured is computed at 54,000*l*. The abundance of soda which we find almost every where at elevations of 6000 to 8000 feet, in the interior table-land of Mexico, is highly favourable to this manufacture.

The town of Puebla was formerly celebrated for its fine manufactories of delft ware (*loza*) and hats. We have already observed, that, till the commencement of the eighteenth century, these two branches of industry enlivened the commerce between Acapulco and Peru. At present there is little or no communication between Puebla and Lima; and the delft manufactories have fallen off so much, on account of the low price of the stone-ware and porcelain of Europe imported at Vera Cruz, that of 46 manufactories which were still existing in 1793, there were in 1802 only sixteen remaining of delft ware, and two of glass.

In New Spain, as well as in the greatest number of countries in Europe, the manufacture of powder

is a royal monopoly. To form an idea of the enormous quantity of powder manufactured and sold in contraband, we have only to bear in mind, that notwithstanding the flourishing state of the Mexican mines, the King has never sold to the miners more than 300,000 or 400,000lbs. of powder per annum; while a single mine, that of Valenciana, requires from 150,000 to 160,000lbs. It appears from the researches I have made, that the quantity of powder manufactured at the expense of the King, is, to that sold fraudulently, in the proportion of 1 to 4. As, in the interior of New Spain, the nitrate of potash and sulphur are every where to be had in abundance, and the contraband manufacturer can afford to sell powder to the miner at nine pence the pound, the Government ought either to diminish the price of the produce of the manufactory, or to throw the trade in powder entirely open. How is it possible to prevent fraud in a country of an immense extent, in mines at a distance from towns, and dispersed on the ridge of the Cordilleras, in the midst of the wildest and most solitary situations?

The royal manufactory of powder, the only one in Mexico, is situated near Santa Fe, in the valley of Mexico, about nine miles from the capital. The buildings, which are very beautiful, were constructed in 1780 from the plans of M. Costanzo, the head of the corps of engineers, in a narrow valley which supplies in abundance the necessary water for setting

hydraulic wheels in motion, and through which the aqueduct of Santa Fe passes. All the parts of the machines, and chiefly the wheels, are disposed with great skill. It is to be wished, however, that the sieves necessary to make the *grain*, were either moved by water or by horses. Eighty Mestizo boys, paid at the rate of 1*s*. 1*d*. per day, are employed in this work. Sulphur, which abounds in the volcanoes of Orizaba and Puebla, in the province of San Luis near Colima, and especially in the intendancy of Guadalaxara, where the rivers bring down considerable masses of it, mixed with fragments of pumice-stone, comes perfectly purified from the town of San Luis Potosi. There were made, in the royal powder manufactory of Santa Fe in 1801, more than 786,000 pounds, of which part is exported for the Havannah. It is to be regretted that this fine edifice, where in general more than half a million of pounds of powder are preserved, is not provided with an electrical conductor. During my stay in New Spain, there were only two conductors in that vast country, which were constructed at La Puebla, by the order of an enlightened administrator, the Count de la Cadena, notwithstanding the imprecations of the Indians, and a parcel of ignorant monks.

We shall conclude the article of the manufactures of New Spain with mentioning the working of gold and the coining of money, which, considered merely with relation to industry and mechanical

improvement, are objects every way worthy of attention. There are few countries in which a more considerable number of large pieces of wrought plate, vases, and church ornaments, are annually executed than in Mexico. The smallest towns have gold- and silver-smiths, in whose shops workmen of all castes, Whites, Mestizoes, and Indians, are employed. The academy of fine arts, and the schools for drawing in Mexico and Xalapa, have very much contributed to diffuse a taste for beautiful antique forms. Services of plate, to the value of from six to eight thousand pounds, have been lately manufactured at Mexico, which for elegance of workmanship may rival the finest works of the kind ever executed in the most civilized parts of Europe. The quantity of precious metals which between 1798 and 1802 was converted into plate at Mexico, amounted on an average to 180lbs. of gold, and 12,564 lbs. of silver per annum.

The Mint of Mexico, which is the largest and richest in the whole world, is a building of very simple architecture, belonging to the palace of the viceroys. This establishment contains little or nothing remarkable with respect to the improvement of the machinery or chemical processes; but it well deserves to engage the attention of travellers, from the order, activity and economy which prevail in all the operations of coining. This interest is enhanced by other considerations which are even

those who do not turn their attention to speculations of political administration. In fact, it is impossible to go over this small building without recollecting that more than 416,000,000*l.* sterling, has issued from it in less than three hundred years, and without reflecting on the powerful influence of these treasures on the destinies of the nations of Europe.

The mint of Mexico was established fourteen years after the destruction of old Tenochtitlan under the first viceroy of New Spain, Antonio de Mendoza, by a royal *cedula* of the 11th May 1535.

The number of workmen employed in this mint amounts to 350 or 400; and the number of machines is so great, that it is possible to coin in the space of a year, without displaying an extraordinary activity, more than thirty millions of dollars, that is to say, nearly three times as much as is generally performed in the sixteen mints which exist in France.

The works of the mint of Mexico contain ten rollers *(laminoirs)*, moved by sixty mules, fifty-two cutters *(coupoirs)*, nine adjusting tables *(bancs d'ajustage)*, twenty machines for marking the edges *(à creneler)*, twenty stamping presses *(balanciers)*, and five mills for amalgamating the washings and filings called *mermas*. As one stamping press can strike in ten hours more than 15,000 dollars, we are not to be astonished that with so great a number of machines they are able to manufacture daily from six to eight thousand pounds weight of silver.

The ordinary work, however, does not exceed from five thousand to five thousand six hundred pounds. From these data, which are founded on official papers, it appears that the silver produced in all the mines of Europe together would not suffice to employ the mint of Mexico more than fifteen days.

The parting house *(casa del apartado)*, in which is carried on the separation of the gold and silver proceeding from the ingots of auriferous silver, formerly belonged to the family of the Marquis de Fagoaga. This important establishment was only annexed to the Crown in 1779. The building is very small and very old.

The *casa del apartado* contains three sorts of works, which are destined, 1st, to the manufacture of glass; 2nd, to the preparation of nitrous acid; and 3rd, to the separation of the gold and silver. The processes used in these different works, are as imperfect as the construction of the glass-work furnaces used for the manufacture of retorts and the distillation of aqua-fortis.

It is surprising that none of the pupils of the School of Mines are employed either in the mint or in the *casa del apartado*; and yet these great establishments might expect useful reforms, from availing themselves of mechanical and chemical knowledge. The mint is also situated in a quarter of the town where running water might be easily procured to put in motion hydraulic wheels. The machinery is yet very far from the perfection which

it has recently attained in England and in France. The improvements will be the more important, as the manufacture embraces a prodigious quantity of gold and silver; for the dollars coined at Mexico may be considered as the matter which maintains the activity of the greatest number of the mints of Europe.

Not only has the working of gold and silver been improved in Mexico, but very considerable progress has also been made in other branches of industry dependent on luxury and wealth. Chandeliers, and other ornaments of great value, were recently executed in gilt bronze, for the new cathedral of Puebla, the bishop of which possesses an income of nearly 23,900*l*. Although the most elegant carriages driven through the streets of Mexico and Santa Fe de Bogota, at from 9,000 to 11,000 feet above the surface of the ocean, come from London, very handsome ones are also made in New Spain. The cabinet-makers execute articles of furniture, remarkable for their form, and for the colour and polish of the wood, which is procured from the equinoctial region adjoining the coast, especially from the forests of Orizaba, San Blas, and Colima. It is impossible to read without interest in the Gazette of Mexico, that even in the *provincias internas*, for example at Durango, 600 miles north of the capital, harpsichords and piano-fortes are manufactured. The Indians display indefatigable patience in the manufacture of small toys, in wood,

bone, and wax. In a country where the vegetation affords the most precious productions*, and where the workman may choose at will the accidents of colour and form among the roots, the medullary prolongations of the wood, and the kernels of fruits, these toys of the Indians may one day become an important article of exportation for Europe. We know what large sums of money this species of industry brings to the inhabitants of Nuremberg, and to the mountaineers of Berchtolsgaden and the Tyrol, who however can only use in the manufacture of boxes, spoons, and children's toys, pine, cherry, and walnut-tree wood. The Americans of the United States send to the island of Cuba, and the other West India Islands, large cargoes of furniture, for which they get the wood chiefly from the Spanish colonies. This branch of industry will pass into the hands of the Mexicans, whenever they shall begin to derive advantage from the productions of their own soil.

Having given a general view of the state of agriculture, and of the manufactures, it remains for us to speak of the exchanges which are carried on with the interior, the mother country, and with other parts of the New Continent. We shall not repeat the just complaints respecting the restrictions on commerce, and the prohibitory system, which

* Swietenia Cedrela and Cæsalpinia wood; trunks of Desmanthus and Mimosa, of which the heart is a red approaching to black.

serve as a basis to the colonial legislation of Europe. It would be difficult to add to what has been already said on that subject, at a time when the great problems of political economy occupy the mind of every man. Instead of attacking principles, whose falsity and injustice are universally acknowledged, we shall confine ourselves to the collection of facts, and to the proving of what importance the commercial relations of Mexico with Europe may become, when they shall be freed from the fetters of an odious monopoly, disadvantageous even to the mother country.

The *internal commerce* comprehends both the carriage of produce and goods into the interior of the country, and the coasting along the shore of the Atlantic and Pacific Oceans. This commerce is not enlivened by an internal navigation on rivers or artificial canals; for, like Persia, the greatest part of New Spain is in want of navigable rivers. The Rio del Norte, which from its breadth hardly yields to the Mississippi, flows through regions susceptible of the highest cultivation, but which in their present state exhibit nothing but a vast desert. This vast river has no greater influence on the activity of the inland trade, than the Missouri, the Cassiquiare, and the Ucayale, which run through the savannahs and uninhabited forests of North America. In Mexico, between the 16th and 23d degrees of latitude, the part of the country where the population is most concentrated, the Rio de Santiago alone

can be rendered navigable at a moderate expense. The length of its course equals that of the Elbe and the Rhone. It fertilizes the table-lands of Lerma, Salamanca, and Selaya, and might serve for the conveyance of flour from the intendancies of Mexico and Guanaxuato towards the western coast. We are of opinion, that it would be very easy to cut canals in the valley of Mexico, from the northern point, the village of Huehuetoca, to the southern extremity, the small town of Chalco.

The principal objects of the internal commerce of New Spain are, 1st, The productions and goods imported and exported at the two ports of Vera Cruz and Acapulco; 2d, The exchange which is carried on between the different provinces, and particularly between Mexico Proper and the *Provincias Internas;* 3d, Several productions of Peru, Quito, and Guatimala, which are conveyed through the country to be exported at Vera Cruz for Europe. Were it not for the great consumption of commodities in the mines, the commerce between provinces which enjoy, in a great measure, the same climate, and which consequently possess the same productions, could not have any great activity. The elevation of the soil gives the southern regions of Mexico, that middle temperature which is necessary for the cultivation of European plants. The same latitude produces the banana, the apple, the sugar-cane, wheat, the manioc, and the potatoe. The nutritive gramina, which vegetate among the

ices of Norway and Siberia, cover the Mexican fields of the torrid zone. Hence, the provinces situated under the 17th and 20th degree of latitude very seldom require the flour of New Biscay. The commerce of maize is of great importance to the provinces of Guadalaxara, Valladolid, Guanaxuato, Mexico, San Luis Potosi, Vera Cruz, Puebla, and Oaxaca.

Thousands of mules, arriving every week from Chihuahua and Durango at Mexico, carry, besides bars of silver, hides, tallow, some wine of Paso del Norte, and flour; and they take in return woollen cloth of the manufacture of Puebla and Queretaro, goods from Europe and the Philippine Islands, iron, steel, and mercury.

The communications with Europe and Asia being carried on only from the two ports of Vera Cruz and Acapulco, all the objects of exportation and importation necessarily pass through the capital, which has become through that means the central point of the interior commerce. Mexico, situated on the ridge of the Cordilleras, commanding as it were the two seas, is distant in a straight line from Vera Cruz 207 miles, from Acapulco 198, from Oaxaca 237, and 1320 from Santa Fe of New Mexico. From this position of the capital, the most frequented roads, and the most important for commerce, are, 1st, the road from Mexico to Vera Cruz, by Puebla and Xalapa; 2d, the road from Mexico to Acapulco, by Chilpanzingo; 3d, the road from Mexico to Guatimala, by Oaxaca;

4th, the road from Mexico to Durango and Santa Fe of New Mexico, vulgarly called *el camino de tierra dentro*. We may consider the roads which lead from Mexico, either to San Luis Potosi and Monterey, or to Valladolid and Guadalaxara, as ramifications of the great road of the *provincias internas*.

The state of the external commerce of New Spain has changed very much within these twelve or fifteen years. The quantity of foreign goods imported fraudulently into the east and west coasts of Mexico, has increased not in volume but in intrinsic value. A greater number of vessels are not employed in the smuggling trade with Jamaica, but the objects of importation have changed with the increase of luxury and national wealth. Mexico now requires finer cloths, a greater quantity of muslins, gauzes, silks, wines, and liquors, than previous to 1791. If on the one hand the increase of luxury has rendered Mexico within the last fifteen or twenty years more dependent on Europe and Asia than formerly, on the other hand the produce of the mines has considerably increased. According to the accounts of the *Consulado*, the importation of Vera Cruz, calculating only from the registers of the customs, amounted before 1791 to 2,335,000*l.*; and it now amounts, at an average, to more than 3,070,000*l.* annually. In the ten years preceding 1791, the mean produce of the mines of New Spain amounted to 4,115,000*l.* per annum, while from

1791 to 1801 the produce amounted to 5,000,000*l.* annually. In this last period the indigenous manufactures have been exceedingly prosperous; but at the same time, as the Indians and people of colour are better clothed, this progress of the Mexican manufactures has had no sensible effect on the importation of Europe—cloth, Indian cottons, and other goods of foreign manufacture. The produce of agriculture has increased in a greater proportion than the manufacturing industry.

Bringing together into one point of view the data collected by me respecting the trade of Acapulco and Vera Cruz, we find that in the beginning of the nineteenth century,

The *importation* of foreign goods and produce into the kingdom of New Spain, including the contraband on the eastern and western coasts, amounts to 4,333,000*l.*

The *exportation* from New Spain of the produce of its agriculture and manufacturing industry amounts to 1,260,000*l.*

Now the mines produce 5,000,000*l.*, of which about 1,750,000*l.* are exported on account of the King, either for Spain, or the other Spanish colonies: consequently, if we deduct from the 3,250,000*l.* remaining, 3,070,000*l.* to liquidate the excess of the importation over the exportation, we find hardly

180,000*l.* The national wealth, or rather the specie, of Mexico is then annually on the increase.

This calculation, founded on exact data, explains the reason why the country, whose mines are the richest and most constant in their produce, does not possess a great mass of specie, and why the price of labour still remains very low there. Enormous sums are accumulated in the hands of a few individuals; but the indigence of the people is very striking to Europeans who travel through the country and the towns of the interior of Mexico. I am tempted to believe that of the 19,770,000*l.* which are supposed to exist in specie among the thirteen or fourteen millions of inhabitants of the Spanish colonies of continental America, 12,000,000*l.* or 13,000,000*l.* are to be found in Mexico. Although the population of this kingdom is not in the proportion of one to two to the population of the other continental colonies, its national wealth is to that of the other colonies nearly in the proportion of two to three. The estimate of 13,000,000*l.* gives only 2*l.* 3*s.* 4*d.* per head; but this sum must appear too great, when we reflect, that in Spain 1*l.* 10*s.* 4*d.*, and in France 3*l.* 0*s.* 8*d.*, are allowed for each inhabitant.

If, in consequence of those events, of which we have examples in the history of every age, the colonies had separated from the mother country, Mexico would have lost 1,933,000*l.* of specie less annually, which were partly paid into the royal

treasury of Madrid, and partly, under the improper denomination of *situados*, paid into the provincial treasuries of the Havannah, Porto Rico, Pensacola, and Manilla. By allowing a free course to the national industry, by encouraging agriculture and manufactures, the importation will diminish of itself; and it will then be easy for the Mexicans to pay the value of foreign commodities with the productions of their own soil. The free cultivation of the vine and the olive on the table-land of New Spain; the free distillation of spirits from rum, rice, and the grape; the exportation of flour favoured by the making of new roads; the increase of plantations of sugar-cane, cotton, and tobacco; the working of the iron and mercury mines; and the manufacture of steel, will perhaps one day become more inexhaustible sources of wealth than all the veins of gold and silver united. Under more favourable external circumstances, the balance of trade may be favourable to New Spain, without paying the account, which has been opened for centuries between the two continents, entirely with Mexican dollars.

In the present state of the trade of Vera Cruz and Acapulco, the total value of exported agricultural produce scarcely equals the value of the sugar furnished by the island of Cuba, which amounts to 1,254,000*l.* But the importation of Mexico, which we calculate on an average at 4,333,000*l.* annually, is an object of the very highest import-

ance for the commercial nations of Europe, who want an outlet for their manufactures. We shall call to mind on this occasion, 1st, That the United States of North America, whose exportation in 1802 amounted to 15,570,328*l.*, exported in 1791 only to the value of 4,115,000*l.*; 2nd, That England, at the period of the greatest activity of its trade with France in 1790, only imported into that country goods to the value of 1,235,000*l.*; and 3rd, That the exportation from England to Portugal and Germany in 1790 did not exceed, to the former country 1,647,000*l.*, and to the latter 2,687,000*l.* These data are sufficient to explain, why towards the end of the last century Great Britain made so many efforts to procure a share of the trade between the Peninsula and Mexico.

The *foreign commerce* of New Spain, from the position of the coasts, is naturally composed of the commerce of the South Sea and that of the Atlantic Ocean. The ports on the eastern coast are Campeche, Huasacualco, Vera Cruz, Tampico, and Nuevo Santander; if we may give the name of ports to roads surrounded with shallows, or mouths of rivers shut by bars, and presenting a very slight shelter from the fury of the north winds. All the endeavours which have been made, since 1524, to discover a safer port than Vera Cruz have been fruitless. The vast shore which stretches from Nuevo Santander to the north and north-west is still very little known; and we may repeat in our

days, what Cortez wrote to the Emperor Charles the Fifth, three years after the taking of Tenochtitlan, " that the secret of the coast which extends from the Rio de Panuco to Florida remains to be discovered."

For centuries, almost all the maritime commerce of New Spain has been concentrated at Vera Cruz. When we bestow a glance on the chart of that port, we see that the pilots of Cortez's squadron were right in comparing the port of Vera Cruz to a pierced bag. The good anchorage in the port of Vera Cruz is between the castle of Ulua, the town, and the sand banks of La Lavandera. Near the castle we find six fathoms water; but the channel by which the port is entered is hardly four fathoms in depth, and 1260 feet in breadth.

The principal objects of exportation at Vera Cruz are, gold and silver in ingots, or converted into coin or wrought plate, cochineal, sugar, flour, Mexican indigo, salted meat and other eatables, tanned hides, sarsaparilla, vanilla, jalap, soap, Campeche wood, and pimento. Their annual amount, according to the declarations at the Customs, taking an average of several years of peace, is 4,770,000*l.* We have not mentioned the indigo of Guatimala or the cocoa of Guayaquil, which in time of war are very important articles in the trade of Vera Cruz, because we wished to confine ourselves to the indigenous productions of New Spain.

The importation of Vera Cruz includes the

following articles: linen and cotton and woollen cloth, silks, paper, brandy, cocoa, mercury, iron, steel, wine, and wax. Their average annual value is 3,250,000*l.*—Commercial circulation, 8,020,000*l.*

CHAPTER VI.

Intendancy of Vera Cruz—situation—physical aspect—climate—productions—road from the capital to Vera Cruz port—yellow fever.

Extent in North Latitude.	Extent in West Longitude.	Population in 1803.	Extent of Surface in square Miles.	No. of Inhabitants to the square Mile.
From 20° 0′ to 21° 15′	From 99° 0′ to 101° 5′	156,000	37,269	4 to 5

BEFORE entering on the subject of the Mines, which we shall treat in considerable detail, we shall subjoin to our brief account of the Commerce of Mexico some description of the Province, through which lies all communication between the interior and Europe.

N.B.—The province of Vera Cruz, situated under the burning sun of the tropics, extends along the Mexican Gulf, from the Rio Baraderas (or *de los Lagartos*) to the great river of Panuco, which rises in the metalliferous mountains of San Luis Potosi. Hence this intendancy includes a very considerable part of the eastern coast of New Spain. Its length, from the bay of Terminos near the island of Carmen to the small port of Tampico, is 630 miles, while its

breadth is only in general from 70 to 80 miles. It is bounded on the east by the peninsula of Merida; on the west, by the intendancies of Oaxaca, Puebla, and Mexico; and on the north, by the colony of New Santander.

There are few regions in the new continent where the traveller is more struck with the assemblage of the most opposite climates All the western part of the intendancy of Vera Cruz forms the declivity of the Cordilleras of Anahuac. In the space of a day, the inhabitants descend from the regions of eternal snow to the plains in the vicinity of the sea, where the most suffocating heat prevails. The admirable order with which different tribes of vegetables rise above one another by strata, as it were, is no where more perceptible than in ascending from the port of Vera Cruz to the table-land of Perote. We see there the physiognomy of the country, the aspect of the sky, the form of plants, the figures of animals, the manners of the inhabitants, and the kind of cultivation followed by them, assume a different appearance at every step of our progress.

As we ascend, nature appears gradually less animated, the beauty of the vegetable forms diminishes, the shoots become less succulent, and the flowers less coloured. The aspect of the Mexican oak quiets the alarms of travellers newly landed at Vera Cruz. Its presence demonstrates to him that he has left behind him the zone so justly dreaded by the people of the north, under which the yellow fe-

ver exercises its ravages in New Spain. This lower range of oaks warns the colonist who inhabits the central table-land, how far he may descend towards the coast without dread of the mortal disease the *vomito*. Forests of liquid amber, near Xalapa, show by the freshness of their verdure that this is the elevation at which the clouds suspended over the ocean come in contact with the basaltic summits of the Cordillera. A little higher, near La Blanderilla, the nutritive fruit of the banana tree no longer comes to maturity. In this foggy and cold region, therefore, want spurs on the Indian to labour, and excites his industry. At the height of San Miguel, pines begin to mingle with the oaks which are found by the traveller as high as the elevated plains of Perote, where he beholds the delightful aspect of fields sown with wheat. About 2000 feet higher the coldness of the climate will no longer admit of the vegetation of oaks; and pines alone cover the rocks, whose summits enter the zone of eternal snow. Thus in a few hours the naturalist, in this miraculous country, ascends the whole scale of vegetation from the heliconia and the banana plant, whose glossy leaves swell out into extraordinary dimensions, to the stunted parenchyma of the resinous trees.

The province of Vera Cruz is enriched by nature with the most precious productions. At the foot of the Cordillera, in the ever-green forests of Papantla, Nautla, and S. Andre Tuxtla, grows the *epidendrum vanilla*, the odoriferous fruit of which

is employed for perfuming chocolate. Near the Indian villages of Colipa and Misantla grows the beautiful *convolvulus jalapæ*, whose tuberose root furnishes the jalap, one of the most energetic and beneficent purgatives. The myrtle (*myrtus pimenta*), whose grain forms an agreeable spice, well known in trade by the name of *pimienta de Tabasco*, is produced in the forests which extend towards the river of Baraderas, in the eastern part of the intendancy of Vera Cruz. The cocoa of Acayucan would be in request, if the natives were to apply themselves more assiduously to the cultivation of cocoa trees. On the eastern and southern declivities of the Pic d'Orizaba, in the valleys which extend towards the small town of Cordoba, tobacco of an excellent quality is cultivated, which yields an annual revenue to the crown of more than 750,000*l.* sterling. The *similax*, the root of which is the true salsaparilla, grows in the humid and umbrageous ravines of the Cordillera. The cotton of the coast of Vera Cruz is celebrated for its fineness and whiteness. The sugar-cane yields nearly as much sugar as in the island of Cuba, and more than in the plantations of St. Domingo.

This intendancy alone would keep alive the commerce of the port of Vera Cruz, if the number of colonists were greater, and if their laziness, the effect of the bounty of nature, and the facility of providing without effort for the most urgent wants of life, did not impede the progress of industry. The old population of Mexico was concentrated in

the interior of the country on the table-land. The Mexican tribes who came from northern countries, gave the preference in their migrations to the ridges of the Cordilleras, because they found on them a climate analogous to that of their native country. No doubt, on the first arrival of the Spaniards on the coast of Chalchihucuecan (Vera Cruz), all the country from the river of Papaloapan (Alvarado to Huaxtecapan) was better inhabited and better cultivated than it now is. The conquerors, however, found, as they ascended the table-land, the villages closer together, the fields divided into smaller portions, and the people more polished. The Spaniards, who imagined they founded new cities when they gave European names to Aztec cities, followed the traces of the indigenous civilization. They had very powerful motives for inhabiting the table-land of Anahuac. They dreaded the heat, and the diseases which prevail in the plains. The search after the precious metals, the cultivation of European grain and fruit, the analogy of the climate with that of the Castilles, and other causes, all concurred to fix them on the ridge of the Cordillera. So long as the *Encomenderos*, abusing the rights which they derived from the laws, treated the Indians as serfs, a great number of them were transported from the regions of the coast to the table-land in the interior, either to work in the mines, or merely that they might be near the habitation of their masters. For two centuries the trade in indigo, sugar, and cotton was next to nothing. The

Whites could by no means be induced to settle in the plains, where the true Indian climate prevails, and it appeared that the Europeans came under the tropics merely to inhabit the temperate zone.

Hitherto the Government has neglected every means for increasing the population of this desert coast. From this state of things result a great want of hands, and a scarcity of provisions, singular enough in a country of such great fertility. The wages of an ordinary workman at Vera Cruz are from 4 to 5 shillings per day. A master mason, and every man who follows a particular trade, gains from 10 to 16 shillings per day, that is to say, three times as much as on the central table-land.

Taking our direction from the capital of Mexico towards the east in the road to Vera Cruz, we must advance 180 miles, before arriving at a valley the bottom of which is less than 3000 feet higher than the level of the sea, and in which, consequently, oaks cease to grow.

We have already said that the configuration of the soil in the interior is most favourable for the transport of goods, for navigation, and even for the construction of canals. Great difficulties are, however, opposed by nature to the communication between the interior of the kingdom and the coast. There is an enormous difference of level and temperature, while from Mexico to New Biscay the plain preserves an equal elevation, and consequently a climate rather cold than temperate. From the capital of Mexico to Vera Cruz, the descent is

shorter and more rapid than from the same point to Acapulco.

Of the 250 miles from the capital to the port of Vera Cruz, upwards of 160 belong to the great plain of Anahuac. The rest of the road is a laborious and continued descent, particularly from the small fortress of Perote to the city of Xalapa, and from this site, one of the most beautiful and picturesque in the known world, to La Rinconada. It is the difficulty of this descent which raises the carriage of flour from Mexico to Vera Cruz, and prevents it to this day from competing in Europe with the flour of Philadelphia. We have already mentioned the superb causeway which is constructing along this eastern descent of the Cordillera. This work, due to the great and praiseworthy activity of the merchants of Vera Cruz, will have the most decided influence on the prosperity of the inhabitants of the whole kingdom of New Spain. The place of thousands of mules will be supplied by carriages fit to transport merchandise from sea to sea, which will connect the Asiatic commerce of Acapulco with the European commerce of Vera Cruz.

The inhabitants of Mexico, discontented with the port of Vera Cruz, if we may give the name of port to the most dangerous of all anchorages, entertain the hope of finding out surer channels for the commerce with the mother country. I shall merely name the mouths of the rivers Alvarado

and Guasacualco to the south of Vera Cruz; and to the north of that city the Rio Tampico, and especially the village of Sotto la Marina, near the bar of Santander. These four points have long fixed the attention of the Government; but even there, however advantageous in other respects, the sand-banks prevent the entry of large vessels. These ports would require to be artificially corrected; but it becomes necessary, in the first place, to inquire if the localities are such as to warrant a belief that this expensive remedy would be durable in its effects. It is to be observed, however, that we still know too little of the coasts of New Santander and Texas, particularly that part to the north of the Lake of S. Bernard or Carbonera, to be able to assert that in the whole of this extent nature presents the same obstacles and the same bars.

While civilization is in its infancy, gigantic projects are much more attractive than simple ideas of easier execution. Thus, instead of establishing a system of small canals for the internal navigation of the valley, the minds of the inhabitants have been bewildered, since the time of the viceroy Count Revillagigedo, with vague speculations on the possibility of a communication by water between the capital and the port of Tampico. Seeing the water of the lakes descend by the mountains of Nochistongo into the Rio de Tula (called also Rio de Moctezuma), and by the Rio de Panuco into the Gulf of Mexico, they entertain the hope of opening

the same route to the commerce of Vera Cruz. Goods to the value of more than 4,000,000*l.* are annually transported on mules from the Atlantic coast over the interior table-land, while flour, hides, and metals descend from the central table-land to Vera Cruz. The capital is the emporium of this immense commerce. The road, which, if no canal is attempted, is to be carried from the coast to Perote, will cost nearly a million sterling. Hitherto the air of the port of Tampico has appeared not so prejudicial to the health of Europeans, and the inhabitants of the cold regions of Mexico, as the climate of Vera Cruz. Although the bar of Tampico prevents the entry into the port of vessels drawing more than from 14 to 20 feet water, it would still be preferable to the dangerous anchorage among the shallows of Vera Cruz. From these circumstances a navigation from the capital to Tampico would be desirable, whatever expense might be requisite for the execution of so bold an undertaking.

Expense, however, is not to be feared in a country where a private individual, the Count de la Valenciana, dug, in a single mine, three shafts at an expense of above 350,000*l.* Nor can we deny the possibility of carrying a canal into execution from the valley of Tenochtitlan to Tampico. In the present state of hydraulic architecture, boats may be made to pass over elevated chains of mountains, wherever nature offers points of separation which communicate with two principal recipients.

It remains for us to speak at the end of this chapter of the epidemical disease which prevails on the eastern coast of New Spain, and which during a great part of the year is an obstacle not only to European commerce, but also to the interior communications between the shore and the table-land of Anahuac. The port of Vera Cruz is considered as the principal seat of the yellow fever *(vomito prieto* or *negro)*, to which Europeans landing in Mexico at the period of the great heats frequently fall victims. Some vessels prefer landing at Vera Cruz in the beginning of winter, when the tempests *de los nortes* begin to rage, to exposing themselves in summer to the effects of the *vomito*, and to undergoing a long quarantine on their return to Europe. These circumstances have frequently a very sensible influence on the supply of Mexico and the price of commodities. This destructive scourge produces still more serious effects on the internal commerce. The mines are in want of iron, steel, and mercury, whenever the communication is interrupted between Xalapa and Vera Cruz. We have already seen that the commerce between province and province is carried on by caravans of mules; and the muleteers, as well as the merchants who inhabit the cold and temperate regions of the interior of New Spain, are afraid of descending towards the coast, so long as the *vomito* prevails at Vera Cruz.

The farm of *l'Encero*, near Vera Cruz, which I

found to be 3043 feet above the level of the ocean, is the highest limit of the *vomito*. We have already observed that the Mexican oaks descend no further than that place, being unable to vegetate in a heat sufficient to develop the germ of the yellow fever. Individuals born and brought up at Vera Cruz are not subject to this disease.

The Whites and the Mestizos who inhabit the interior table-land of Mexico, of which the mean temperature is 60° and 62° Fahr., and where the thermometer sometimes falls below the freezing point, are more liable to contract the *vomito*, when they descend from l'Encero to the Plan del Rio, and from thence to la Antigua and the port of Vera Cruz, than the Europeans or inhabitants of the United States, who come by sea. The latter, passing by degrees into the southern latitudes, are gradually prepared for the great heats which they experience on landing; but the Spanish Mexicans, on the other hand, suddenly change their climate, when, in the space of a few hours, they are transported from the temperate region to the torrid zone. The environs of Vera Cruz are frightfully arid. On arriving by the Xalapa road, we find near *la Antigua*, a few cocoa trees which ornament the gardens of that village; and they are the last great trees to be discovered in the desert. The excessive heat which prevails in the town is increased by the hillocks of moving sands (*meganos*) formed by the impetuosity of the north winds, and sur-

rounding it on the south and south-west side. The suffocating heat which prevails in this parched and naked plain, has a powerful effect on individuals whose nervous system has never been accustomed to so violent an irritation. The heat, added to the fatigues of the journey, disposes the organs more easily to receive the deleterious miasmata of the yellow fever: the ravages of that pestilential malady will be greatly diminished, therefore, by shortening that part of the road which crosses the arid plains of the sea coast.

Persons born at Vera Cruz are not liable to contract the *vomito* in their native country; and in this respect they possess a great advantage over the inhabitants of the United States, who suffer from the insalubrity of their own climate. Another advantage of the torrid zone is, that the Europeans, and in general all individuals born in temperate climates, are never twice attacked with the yellow fever.

It is however certain that the *vomito*, which is endemical at Vera Cruz, Carthagena, and the Havannah, is the same disease with the yellow fever, which since the year 1793 has never ceased to afflict the inhabitants of the United States.

It is incontestable that the *vomito* is not contagious at Vera Cruz. In most countries, the common people consider many diseases as contagious which are of a very different character; but no popular opinion in Mexico has ever interdicted the

stranger not seasoned to the climate from approaching the beds of those attacked by the *vomito*. No fact can be cited to render it probable that the immediate contact or breath of the dying person is dangerous to those not seasoned to the climate, who may attend on the patient. On the continent of equinoctial America, the yellow fever is not more contagious than the intermittent fevers of Europe.

Pringle, Lind, and other distinguished physicians, consider our summer and autumnal bilious affections as the first degree of yellow fever. A feeble analogy is also discoverable in the pernicious intermittent fevers which prevail in Italy In the low regions of Mexico, as well as in Europe, the sudden suppression of perspiration is one of the principal occasional causes of the gastric or bilious fevers.

The strangers who frequent Vera Cruz have greatly exaggerated the dirtiness of the inhabitants. For some time the police has taken measures for the preservation of the salubrity of the air; and Vera Cruz is at present not so dirty as many of the towns of the south of Europe; but these precautions must be continued for some years before their good effects will be sensibly felt.

An intimate connexion is observed on the coast of Mexico between the progress of diseases, and the variations of the temperature of the atmosphere. Two seasons only are known at Vera Cruz, that of the tempest of the north (*los Nortes*) from the

autumnal to the spring equinox, and that of the breezes or south winds (*brizas*), which blow with considerable regularity between March and September. The month of January is the coldest in the year, because it is furthest from the two periods in which the sun passes through the zenith of Vera Cruz. The *vomito* generally begins first to rage in that town when the mean temperature of the month reaches 75° Fahr. In December, January, and February, the heat remains below this limit; and accordingly it seldom happens that the yellow fever does not entirely disappear in that season when a very sensible cold is frequently felt. The strong heats begin in the month of March, and the epidemical scourge begins at the same time. Although May is warmer than September and October, it is however in the two last months that the *vomito* commits the greatest ravages; for in every epidemic it requires a certain time before the germ of the disease is developed in all its energy; and the rains, which last from the month of June to the month of September, have an undoubted influence on the production of the miasmata which are formed in the environs of Vera Cruz.

The beginning and the close of the rainy season are dreaded the most under the tropics, because an excessive humidity arrests, almost as much as a great drought, the progress of putrefaction of the vegetable and animal substances which are accumu-

lated in marshy situations. More than 90 inches of rain-water fall annually at Vera Cruz; and in the month of July 1803 alone, an accurate observer, M. Costanzo, colonel of the corps of engineers, collected more than 25 inches, which is only one-third less than the quantity which falls at London during the whole year.

It is a very remarkable fact, that during the eight years which preceded 1794, there was not a single example of *vomito*, although the concourse of Europeans and Mexicans from the interior was extremely great.

CHAPTER VII.

Mineral productions—quantity of gold and silver—copper, tin, iron, lead, mercury, coal, salt.

HAVING given a brief general view of the soil, climate and population of the kingdom of Mexico, it remains for us to exhibit a view of the mineral productions which for two centuries and a half have been the object of working the mines of New Spain. The mountains of the New Continent, like the mountains of the Old, contain iron, copper, lead, and a great number of other mineral substances, indispensable to agriculture and the arts. If the labour of man has, in America, been almost exclusively directed to the extraction of gold and silver, it is because the members of a society act from very different considerations to those which ought to influence the whole society. Wherever the soil can produce both indigo and maize, the former prevails over the latter, although the general interest requires a preference to be given to those vegetables which supply nourishment to man, over those which are merely objects of exchange with strangers. In the same manner, the mines of iron

or lead on the ridge of the Cordilleras, notwithstanding their richness, continue to be neglected, because nearly the whole attention of the colonists is directed to the veins of gold and silver, even when they exhibit on trial but small indications of abundance. Such is the attraction of those precious metals, which, by a general convention, have become the representatives of labour and subsistence.

No doubt the people of Mexico can procure, by means of foreign commerce, all the articles which are supplied to them by their own country; but in the midst of great wealth in gold and silver, want is severely felt whenever the commerce with the mother country, or with other parts of Europe or Asia, has suffered any interruption, or whenever a war throws obstacles in the way of maritime communication. From five to six hundred thousand pounds in piastres are sometimes heaped up in Mexico, while the manufacturers and miners are suffering from the want of steel, iron, and mercury. A few years before my arrival in New Spain, the price of iron rose from about 16*s*. the 100lbs. to 10*l*., and steel from 24*s*. to 54*l*. In those times when there is a total stagnation of foreign commerce, the industry of the Mexicans is awakened for a time, and they then begin to manufacture steel, and to make use of the iron and mercury of the mountains of America. The nation is then alive to its true interest, and feels that wealth consists

in the abundance of objects of consumption, in that of *things*, and not in the accumulation of the *sign* by which they are represented. During the last war but one between Spain and America, they began to work the iron mines of Tecalitan, near Colima, in the intendancy of Guadalaxara. The *Tribunal de Mineria* expended more than 6000*l.* in extracting mercury from the veins of San Juan de la Chica; but the effects of so praiseworthy a zeal were only of short duration; and the peace of Amiens put an end to undertakings which promised to give to the labours of miners a direction more useful to the public prosperity. The maritime communication was scarcely well opened, when they again preferred to purchase steel, iron, and mercury in the markets of Europe.

In proportion as the Mexican population shall increase, and the inhabitants, from being less dependent on Europe, shall begin to turn their attention to the great variety of useful productions contained in the bowels of the earth, the system of mining will undergo a change. An enlightened administration will give encouragement to those labours which are directed to the extraction of mineral substances of an *intrinsic value;* individuals will no longer sacrifice their own interests and those of the public to inveterate prejudices; and they will feel that the working of a mine of coal, iron, or lead, may become as profitable as

that of a vein of silver. In the present state of Mexico, the precious metals occupy almost exclusively the industry of the colonists; and whenever we employ the word mine *(real, real de minas)*, unless the contrary is expressly stated, a gold or silver mine is to be uniformly understood.

Having been engaged from my earliest youth in the study of mining, and having myself had the direction for several years of subterraneous operations in a part of Germany which contains a great variety of minerals, I was doubly interested in examining with care the state of the mines and their management in New Spain. I had occasion to visit the celebrated mines of Tasco, Pachuca, and Guanaxuato, in which last place, where the veins exceed in richness all that has hitherto been discovered in other parts of the world, I resided for more than a month; and I had it in my power to compare the different methods of mining practised in Mexico, with those which I had observed in the former year in Peru. Without, however, entering into discussions of a minute and purely technical nature, I shall confine myself in this work to the examination of what is conducive to general results.

What is the geographical position of the mines which supply this enormous mass of silver, which flows annually from the commerce of Vera Cruz into Europe? Is this enormous mass of silver the

produce of a great number of scattered undertakings, or is it to be considered as almost exclusively furnished by three or four metallic veins of extraordinary wealth and extent? What is the quantity of precious metals annually extracted from the mines of Mexico? And what proportion does this quantity bear to the produce of the mines of the whole of Spanish America? At how many ounces per 100lb may we estimate the mean richness of the silver ore of Mexico? What proportion is there between the quantity of ore which undergoes melting, and that from which gold and silver are extracted by the process of amalgamation? What influence has the price of mercury on the progress of mining, and what quantity of mercury is lost in the process of Mexican amalgamation? Can we know with precision the quantity of precious metals which have passed, since the conquest of Tenochtitlan, from New Spain into Europe and Asia? Is it probable, considering the present method of working, and the geological constitution of the country, that the annual produce of the mines of Mexico will admit of an augmentation? Or shall we conclude, with several celebrated writers, that the exportation of silver from America has already attained its *maximum*? These are the general questions which we now propose to discuss. They are connected with the most important problems of political economy.

Long before the arrival of the Spaniards, the natives of Mexico, as well as those of Peru, were ac-

quainted with the use of several metals. They did not content themselves with those which were found in their native state on the surface of the earth, and particularly in the beds of rivers and the ravines formed by the torrrents; they applied themselves to subterraneous operations in the working of veins; they cut galleries and dug pits of communication and ventilation; and they had instruments adapted for cutting the rock. Cortez informs us in the historical account of his expedition, that gold, silver, copper, lead, and tin, were publicly sold in the great market of Tenochtitlan.

We must however refrain from going into the historical part of this subject; since, however entertaining it may be, it would lead us into details wholly unimportant for our present purpose.

We shall proceed to lay before our readers all the information concerning the produce of the mines which a residence in the country and access to the registers of the mints of Mexico, Lima, Santa Fé, and Popayan, have enabled us to collect. We believe it will be found more full and exact than any hitherto published.

The quantity of silver annually extracted from the mines of New Spain, does not depend so much on the abundance and intrinsic riches of the ores, as on the facility with which the miners procure the mercury necessary for amalgamation. We are not therefore to be surprised that the number of ounces of silver converted into piastres, at the mint of

Mexico, varies very irregularly. When, from the effect of a maritime war or from any other accident, the mercury fails for a year, and the following year it arrives in abundance, a very considerable produce of silver succeeds to a very limited fabrication of money.

In Saxony, where the small quantity of mercury which is wanted for the process of amalgamation, is procured with sufficient facility, the produce of the mines of Freiberg is so admirably equal, that from 1793 to 1799 it was never below 29,800lbs. troy, and never above 31,300lbs. troy of silver. In that country, the great droughts, which stop the working of the hydraulic wheels, and prevent the water from being drawn off, have the same influence on the quantity of silver delivered into the mint, as the scarcity of mercury in America.

From 1777 to 1803, the quantity of silver annually extracted from the Mexican ores has almost constantly been above 1,231,000lbs. troy of silver, and from 1796 to 1799 it was 1,662,000lbs. troy; while from 1800 to 1802 it remained below 1,294,900lbs. troy. But we cannot by any means infer from these data, that the mining operations in Mexico have not been so flourishing latterly. In 1801 the gold and silver obtained amounted only to 3,480,000*l.*; while in 1803 the coinage again amounted, on account of the abundance of mercury, to 4,865,000*l.*

Abstracting the influence of accidental causes, we find that the mines and stream works of New

Spain actually produce on an average 4,322lbs. troy of gold, and 1,543,837lbs. troy of silver, of which the mean value amounts altogether to 4,620,000*l.*

About twenty years ago, this produce was only from 2,170,000*l.* to 3,467,000*l.*, and thirty years ago from 2,380,000*l.* to 2,400,000*l.* In the beginning of the eighteenth century, the quantity of gold and silver coined at Mexico was only from 1,085,000*l.* to 1,200,000*l.* The enormous increase in the produce of the mines observable in latter years is to be attributed to a great number of causes, all acting at the same time; among which the first place must be assigned to the increase of population on the table-land of Mexico, the progress of knowledge and national industry, the freedom of trade conceded to America in 1778, the facility of procuring at a cheaper rate the iron and steel necessary for the mines, the fall in the price of mercury, the discovery of the mines of Catorce and Valenciana, and the establishment of the *Tribunal de Mineria.*

The two years in which the produce of gold and silver attained its *maximum*, were 1796 and 1797. In the former there were coined at the mint of Mexico, 25,644,000 piastres; and in the latter, 23,080,000 piastres. To judge of the effect produced by the freedom of trade, or rather from the cessation of the monopoly of the galleons, we have merely to remember that the value of the gold and silver coined at Mexico was, from 1766 to 1778,

191,589,179 piastres; and from 1779 to 1791, 252,525,412 piastres; so that from 1778, the increase has been more than a fourth part of the total produce.

The mines of New Spain have produced from 1690 to 1800, the enormous sum of 92,229,256 lbs. troy; and from 1690 to 1803, gold and silver to the value of 284,224,924*l.* sterling.

For a hundred and thirteen years, the produce of the mines has been constantly on the increase, if we except the single period frm 1760 to 1767. This increase becomes manifest, when we compare, every ten years, the quantity of the precious metals given in to the mint of Mexico, as is done in the following tables, of which the one indicates the value of the gold and silver in pounds sterling, and the other, the quantity of silver in pounds troy.

Progress of the mining operations of Mexico.

Table I. *Gold and Silver.*

Period.	Value in pounds sterling		
	£.	s.	d.
From 1690 to 1699	9,505,455	18	4
1700 1709	11,208,390	14	0
1710 1719	14,245,189	3	8
1720 1729	18,233,198	1	4
1730 1739	16,614,774	16	8
1740 1749	24,235,258	13	4
1750 1759	27,245,853	14	0
1760 1769	24,446,253	0	0
1770 1779	35,789,374	12	4
1780 1789	41,925,986	14	0
1790 1799	50,067,379	14	0
Total from 1690 to 1799--	£276,517,115	6	8

Table II. *Silver alone.*

Period.	Silver.	
	Troy lbs.	Oz.
From 1690 to 1699	3,194,568	3
1700 1709	3,773,001	10
1710 1719	4,782,511	6
1720 1729	6,166,375	5
1730 1739	6,577,081	2
1740 1749	7,450,180	2
1750 1759	9,135,760	0
1760 1769	8,200,776	3
1770 1779	12,017,963	0
1780 1789	13,616,912	2
1790 1799	16,065,557	6
Total from 1690 to 1799	60,980,685	3

When we distinguish those periods in which the progress of mining has been most rapid, we find the following results:

Periods.	Value of Gold and Silver, for an average year, in pounds sterling.			Progressive increase.			
	£.	s.	d		£.	s.	d.
1690 to 1720	1,182,746	10	0	In 27 years	801,666	13	4
1721 1743	1,988,516	8	0				
1744 1770	2,568,545	8	4	25	433,333	6	8
1771 1782	3,731,848	9	4	19	1,148,333	6	8
1783 1790	4,228,700	17	8	12	498,333	6	8
1791 1803	4,837,261	17	4	10	311,666	13	4

This table, along with the preceding, proves that the periods during which the wealth of the mines have most increased, are from 1736 to 1745, from 1777 to 1783, and from 1788 to 1798; but the increase in general has been so little in proportion to the space of time, that the total produce of the mines was:

£.	s.	d.		
866,666	13	4	in	1695
1,733,333	6	8	-	1726
2,600,000	0	0	-	1747
3,466,666	13	4	-	1776
4,333,333	6	8	-	1788
5,200,000	0	0	-	1795

from whence it follows that the produce has been

tripled in fifty-two years, and sextupled in a hundred years.

After gold and silver, it remains for us to speak of the other metals, called common metals, the working of which, as we have already stated in the beginning of this chapter, has been very much neglected. *Copper* is found in a native state, and under the forms of vitreous and oxidulated copper, in the mines of Ingaran, a little to the south of the Volcano of Jorullo, at San Juan Guetamo, in the intendancy of Valladolid, and in the province of New Mexico. The Mexican *tin* is obtained by means of washing, from the alluvial soil of the intendancy of Guanaxuato, near Gigante, San Felipe, Robledal and San Miguel el Grande, as well as in the intendancy of Zacatecas between the towns of Xeres and Villa Nueva. One of the ores of tin most common in Mexico is the *wood tin* of the English mineralogists. It appears that this mineral is originally found in veins which traverse trap-porphyries; but the natives, instead of working these veins, prefer the extracting of tin from the earth brought down the ravines. The intendancy of Guanaxuato in 1802 produced nearly 110 tons of copper, and 5 tons of tin.

The iron mines are more abundant than is generally believed, in the intendancies of Valladolid, Zacatecas, and Guadalaxara, and especially in the *provincias internas*.

These mines are only wrought with any degree of spirit during a period of maritime war, when a stop is put to the importation of steel and iron from Europe. The veins of Tecalitan, near Colima, were successfully wrought ten years ago, and afterwards abandoned. Ores of compact red iron-stone have been observed in the intendancy of San Luis Potosi near Catorce. I saw crystallized micaceous iron, near the village of Santa Cruz, east from Celaya, on the fertile table-land extending from Queretaro to Guanaxuato.

Lead, which is very rare in the north of Asia, abounds in the mountains of calcareous formation, contained in the north-east part of New Spain. The lead mines are not wrought with so much spirit as might be desired in a country where the fourth part of all the silver minerals are smelted.

Among the metals of which the use is the most limited, we have to name *zinc*, which is found, under the form of brown and black blende, in the veins of Ramos, Sombrerete, Zacatecas, and Tasco; *antimony*, which is common to Catorce and Los Pozuelos, near Cuencame; *arsenic*, which is found among the minerals of Zimapan, combined with sulphur, as orpiment. *Cobalt*, as far as I know, has never yet been discovered among the minerals of New Spain; and *manganese*, which M. Ramirez recently discovered in the island of Cuba, appears to me in general much less abundant in Equinoctial America, than

it is in the temperate climates of the Old Continent.

Mercury, which is very remote from *tin*, with respect to its relative antiquity, or the period of its formation, is almost as uncommon as it is in every part of the globe. The inhabitants of New Spain have for centuries procured the mercury necessary in the process of amalgamation, partly from Peru and partly from Europe; and hence they are accustomed to consider their country as destitute of this metal. When however we consider the examinations carried on under the reign of Charles the Fourth, we must admit that few countries have so many indications of cinnabar, as the table-land of the Cordilleras from the 19th to the 22d degree of north latitude. In the intendancies of Guanaxuato and Mexico, we find it in many places. Sulphuret of mercury has been also discovered in the intendancy of Valladolid; at Los Pregones near Tasco, in the district of mines of the Doctor; and in the valley of Tenochtitlan to the south of Gassavé in the road from Mexico to Pachuca. The works carried on for the discovery of these different mineral repositories have been so frequently interrupted, and they have been conducted with so little zeal, and generally with so little intelligence, that it would be very imprudent to assert, as has been often done, that the mercury mines of New Spain are not worth working. It appears, on the contrary, from the interesting information which we owe to the labours of

M Chovel, that the veins of San Juan de la Chica, as well as those of the Rincon del Centeno, and the Gigante, are very deserving of the attention of the Mexican miners. Was it to be expected that superficial works which were merely begun, should in the very first years yield a net profit to the shareholders?

America in its present state is the tributary of Europe with respect to mercury; but it is probable that this dependence will not be of long duration, if the ties which unite the Colonies with the mother country remain long loosened, and if civilization is progressive in America. The spirit of enterprise and research will increase with the population; the more numerous are the inhabitants of the country, the more will they learn to appreciate the natural wealth which is contained in the bowels of their mountains. If they discover no single mine equal in wealth to the celebrated one of Huancavelica, they will work several at once, the united produce of which will render the importation of mercury from Spain and Carniola unnecessary. These changes will be so much the more rapidly effected, as the Peruvian and Mexican miners shall feel themselves impeded by the want of the metal necessary for amalgamation. The mineral depositaries of New Spain, if examined with care, and worked with constancy, may one day produce a very considerable quantity of mercury. The period approaches when the Spanish Colonies, being more united together,

will be more attentive to their common interests: it becomes, therefore, of consequence to observe the indications of mercury in South America. Mexico and Peru, instead of receiving this metal from Europe, will one day, perhaps, be able to supply the Old world with it.

We may also hope that, in proportion as the inhabitants of the New world shall learn to profit by the natural wealth of the soil, the improvement of chemical knowledge will discover processes of amalgamation by which less mercury is consumed. By diminishing the consumption of this metal, and increasing the produce of the indigenous mines, the American miners will gradually learn to dispense with the mercury of Europe and China.

To complete the view of the mineral substances of New Spain, it remains for us to name coal, salt, and soda. The *coal*, of which I saw in the valley of Bogota beds at 7,500 feet of elevation above the level of the sea, in general appears to be very rare in the Cordilleras. In the kingdom of New Spain it has only yet been discovered in New Mexico; it is however probable that it may be found in the secondary formations which extend to the north and north-west of the Rio Colorado, as well as in the plains of San Luis Potosi and Texas. There is already a coal mine near the sources of the Rio Sabina. In general, coal and rock salt abound to the west of the Sierra Verde near the lake of Timpanogos, in Upper Louisiana, and in those vast northern regions situated

between the *stony mountains* of Mackenzie and Hudson's Bay.

Deposits of coal abound beyond the tropics in New Mexico, in the middle of the salt plains of Moqui and Nabajoa, and to the east of the Rocky Mountains, as also towards the sources of the Rio Sabina, in that immense basin covered with secondary formations, in which flow the Missouri and the Arkansas.

An able engineer, M. Lafond, whose map throws much light on these countries, observes, that eight leagues north from the post of Chichi there are hills abounding in coal, from which a subterraneous noise is heard at a distance like the discharge of artillery. Does this curious phenomenon announce a disengagement of hydrogen produced by a bed of coal in a state of inflammation?

In the whole inhabited part of New Spain, there is no rock salt like that of Zipaquira in the kingdom of Santa Fe, or of Wieliczka in Poland. The muriate of soda is no where found collected in banks or masses of considerable volume; it is merely disseminated in the argillaceous soil which covers the ridge of the Cordilleras.

The most abundant salt mine of Mexico is the lake of the *Peñon Blanco*, in the intendancy of San Luis Potosi, of which the bottom is a bed of clay which contains from 12 to 13 per cent. of muriate of soda. We ought also to observe, that were it not for the amalgamation of silver ores, the con-

sumption of salt would be very inconsiderable in Mexico, because the Indians, who constitute a great part of the population, have never abandoned the old custom of seasoning their food with *chile* or pimento instead of salt.

NOTE A.

In speaking of the common metals which may be found in Mexico, I think the probability of their value, as an object of research, is overrated. Not that I doubt that they may be found, and perhaps in some instances abundantly; but unless fuel could be supplied in much larger quantity than at present, it cannot pay to work them.—For instance, iron and copper require such a great weight of coal that they cannot be worked to advantage without it; and when we take into account the expense of transporting and erecting machinery, the fuel required for merely draining the mines, the rate of wages of the miners of Mexico, and the charge of carrying the produce to the coast, we shall see at once, that though all these expenses may be borne by silver and gold mines, nothing but a great falling off in the supply from other countries, and a proportionable advance in price, can warrant the application of them to mines of the inferior metals.

An exception may be made in respect to mercury and lead.—The former may indeed be reckoned as a precious metal, and one of which the supply is limited, being only now found in Spain and Germany: it is also, according to the present practice, essential in Mexico for the extraction of gold and silver from the ores: and though I am of opinion that, if fuel can be obtained, it would be better to discontinue the use of mercury, yet I would strongly recommend M. de Humboldt's remarks to the attention of persons working mines in Mexico, and that

every inquiry and research should be made as to veins likely to produce quicksilver.

If smelting should ever be extensively practised in Mexico instead of amalgamation, lead would be the substitute for quicksilver, and a great consumption of it would take place, as in the process much would be dissipated or destroyed. This demand for it on the spot would render it valuable, and it would be applied in the state of ore. There is also every reason to think that the lead ores of Mexico may frequently contain silver in sufficient proportion to make it worth while to work them.

J. T.

Note B.

Coal.—M. de Humboldt mentions this substance in the preceding chapter as having hitherto been found only in New Mexico, which is far too distant north for the supply of any of the mines now likely to be worked. It has however been also found in Peru and Chili, and some late accounts warrant the belief that it may be yet discovered within reach of the silver mines.

In a letter which I had the honour to receive, containing some information from M. de Humboldt himself, dated at Paris, on the 12th Jan. last, (1824,) he tells me, that "he thinks that he "has insisted too much in his works upon the difficulties of "supplying fuel for steam engines: That this difficulty is not "so great in general in Mexico as in Peru, as far as relates to "wood; because, in the latter, nature has deposited the mineral "treasures at such great elevations, that they are found almost "at the highest limits of all vegetation; whereas, upon the ta-"ble-land of Mexico, though wood is not plentiful, yet a good "deal is to be found, as at Guanaxuato, from its proximity to "the Sierra de Santa Rosa: That there are also good woods "near Real del Monte, at l' Oyamel, and at Cerro del Sacal."

He also says, "that some coal has been found, but that he "does not know of any in the domains of Count Regla," which had been reported to be the case; and he goes on to observe, "that the formations of basalt and amygdaloid, which are com-"mon there, might indicate the presence of Lignite or Bovey "coal, which would be very useful."

This observation of M. de Humboldt has, in some degree, been confirmed, as there have lately arrived in England some specimens of a kind of coal from the district he speaks of, which, though not exactly the same as the one he mentions, is nearly allied to it, and appears to be what Professor Jameson has called *pitch coal*. It has the appearance of jet, is found in several coal-fields in Scotland, in some in England, and in Hungary, where the minerals generally remarkably resemble those of Mexico.

The letter above mentioned goes on to say, "that he had "seen secondary formations resting upon the metalliferous por- "phyries about Actopan and Totonilcos; so that, geognostically "speaking, it is possible that true coal might be discovered "there." Some further remarks on this subject will be found in the next chapter.—J. T.

CHAPTER VIII.

Geological description of the mining districts of Mexico.

When we examine the solid mass of our globe, we soon perceive that some of the substances, which descriptive mineralogy has made known to us separately, are found in *constant associations*, and that those associations, which are called compound rocks, do not vary, like organized beings, according to the difference of latitude, or of the temperature under which they are placed. Geognosts, who have travelled through the most distant countries, have not only found, for the most part, in the two hemispheres, the same simple substances, quartz, feldspar, mica, garnet, and hornblende; but they have also observed that mountain-masses display every where the same rocks; that is, the same assemblages of mica, quartz, and feldspar, in granite; of mica, quartz, and garnets, in mica-slate; and of feldspar and hornblende, in syenite. If it has sometimes been considered, that a rock belongs exclusively to a single portion of the globe, subsequent researches have shown, that it also occurs in regions the most distant from its first locality. Thus we are almost led to admit, that the formation of rocks has been independent of

the diversity of climates, and perhaps anterior to its existence.* There is an identity even in those rocks where organized bodies are the most variously modified.

Transition clay-slate† forms far greater masses in the globe than primitive clay-slate. The latter is generally subordinate to mica-slate; as an independent formation, it is as rare in the Pyrenees and the Alps, as in the Cordilleras. In South America, between the parallels of 10° north and 7° south, I saw transition clay-slate only on the southern declivity of the littoral chain of Venezuela, at the entrance of the Llanos of Calaboza. The basin of the Llanos, the bottom of an ancient lake covered with secondary formations (red sandstone, zechstein, and clay-gypsum), is bounded by a band of intermediary formation of clay-slate, black limestone, and euphotide, connected with transition greenstone. Gneiss and mica-slate, between the valleys of Avague and the Villa de Ceura, constitute only one formation on which clay-slate reposes in conformable position, in the ravines of Malpasso and Piedras azules (direction N. 52° E.; inclin. 70° towards the N.W.), of which the lower

* Humboldt, Geography of Plants, 1807, p. 115. Idem, Views of the Cordilleras, vol. i. p. 122.

† The *transition clay-slate* in Cornwall is called *killas*, and indeed the same general term includes *primitive clay-slate*. This remark will enable the miners of that county to understand the description of rocks in the text.—J T.

beds are green, steatitic, and mixed with hornblende, and the upper are of a greyish-green and darkish-blue colour. This clay-slate contains (like that of Steben, in Franconia, the duchy of Nassau, and of Peschels-Mühle in Saxony) beds of greenstone, sometimes massive, at other times of a globular structure.

The famous vein of Guanaxuato in New Spain, which, from 1786 to 1803, has produced yearly, on an average, 343,000lbs. troy of silver, also traverses transition clay-slate. This rock, in its lower strata, passes, in the mine of Valenciana, (at the height of 932 fathoms above the level of the sea,) to a talcose slate; and I described it in my *Political Essay* as placed on the limit of the primitive and intermediary formations. A more particular examination of the relations of position which I noted on the spot, and the comparison of the beds of syenite and serpentine which have been pierced in digging the great shaft, with the beds that are interposed in the transition formations of Saxony, of the Bochetta of Genoa, and of the Cotentin, convinced me that the clay-slate of Guanaxuato belongs to the most ancient intermediary formations. We do not know whether its stratification be *parallel* and *conformable* with that of the granite-gneiss of Zacatecas, and of Peñon blanco, which probably supports it, the contact of these formations not having been observed; but almost all the porphyry-rocks on the great table-land of Mexico

follow the general direction of the chain of mountains (N. 40°, 50° W.). This *perfect concordance* (gleichförmigkeit der lagerung) has been observed between the primitive gneiss and the transition clay-slate of Saxony (Friedricks-walde; valleys of Müglitz, Seidewitz, and Lockwitz); it proves that the formation of the intermediary series immediately succeeded that of the last beds of the primitive series. In the Pyrenees, as M. de Charpentier has observed, the former of these series is found in a different position (not parallel), sometimes in *transgressive position* (übergreifende lagerung) with the latter. I shall observe, on this occasion, that the parallelism between the stratification of two *consecutive formations*, or the absence of this parallelism, does not alone decide the question whether the two formations are united or not in the same primitive or secondary series; it is rather the sum of these geognostic relations that solves that problem. The clay-slate of Guanaxuato is very regularly stratified (direct. N. 46° W.; inclin. 45° S.W.), and the form of the valleys has no influence on the direction or inclination of the strata. We distinguish there three varieties, which may be considered as three epochas of formation; a clay-slate of a silvery lustre, and steatitic, passing to a talc-slate (talk-schiefer); a greenish clay-slate, with a silky lustre, resembling chlorite slate; finally, a black clay-slate, in very thin laminæ, surcharged with carbon, staining the figures like ampelite and the marly slate of zechstein, but not effervescing

with acids. I have named these varieties in the order in which I observed them from below upwards, in the mine of Valenciana, which is 263 fathoms in perpendicular depth; but in the mines of Mellado, Animas, and Rayas, the supercarburetted clay-slate *(hoja de libro)* occurs beneath the green and steatitic variety; and it is probable, that the strata which pass to talc-slate, chlorite, and ampelite, alternate several times with each other.

The thickness of this formation of transition clay-slate, which I found at the mountain of Santa-Rosa near Los Joares, where the Indians collect ice in small artificial basins, is more than 3000 feet. It contains in subordinate beds, not only syenite (like the transition clay-slate of the Cotentin), but also, which is very remarkable, serpentine, and a hornblende-slate that is not greenstone. In digging in the massive rock, the great shaft of Valenciana, which has cost nearly 292,000*l*., the following strata were found, reckoning downwards for ninety-four fathoms of depth: an ancient conglomerate, representing the red sandstone; black transition clay-slate, strongly carburetted, in very thin laminæ; clay-slate, blueish-grey, and containing magnesia; hornblende-slate, greenish-black, a little mixed with quartz and pyrites, destitute of feldspar, not passing to greenstone, and altogether similar to the hornblende-slate (hornblend-schiefer) which forms beds in primitive gneiss and mica-slate; green serpentine of uneven fracture and fine grain, dull, but translucent on the edges, containing much

pyrites, destitute of garnets, and diallage metalloid (schillerspath) mixed with talc and steatite; hornblende-slate; syenite, or a granular mixture of much darkish-green hornblende, yellowish quartz, and a little lamellar and white feldspar. This syenite splits into very thin layers; the quartz and feldspar are so irregularly spread, that they sometimes form small veins in a paste of hornblende. The syenite is the largest of these eight interposed beds, of which the direction and inclination are exactly parallel to that of the whole rock; it is more than 180 feet thick; and as I saw in the deepest working of the mine *(planes* of San Bernardo), at 172 fathoms below the bed of syenite, carburetted clay-slate occurring again, identical with that in which new shafts are beginning to be sunk, no doubt can remain that hornblende-slate alternating twice with serpentine, and serpentine alternating probably with syenite, form beds subordinate to the great mass of clay-slate of Guanaxuato. The connexion which we have just remarked between hornblende-rocks and serpentine, is found in other parts of the globe, in formations of euphotide of different ages; for instance, at Heidelberg near Zell in Franconia; at Keilwig in the northern extremity of Norway; at Portsoy in Scotland; and at the island of Cuba, between Regla and Guanavacoa*.

* The *syenite* here spoken of will best be understood in Cornwall, as a species of *elvan*; which term, however, more properly belongs to what is now called *porphyry*.—J. T.

I saw no remains of organized bodies, nor beds of porphyry, grauwacke, nor lydian stone, in the transition clay-slate of Guanaxuato, which is the rock richest in silver that has hitherto been found; but this clay-slate is covered in conformable position in some places by transition porphyries very regularly stratified (los Alamos de la Sierra); in some by greenstone and syenites alternating thousands of times together (between Esperanca and Comangillas); and in others, either by a calcareous conglomerate or by transition limestone of a blueish-grey colour, mixed with clay, and fine-grained (ravine of Acabuca), or by red sandstone (Marfil). These relations of the clay-slate of Guanaxuato, with the rocks which it supports, and some of which (the syenites) appear first as subordinate beds, suffice to place it among the transition formations; above all, they justify this result in the opinion of those geognosts who are acquainted with the observations which have been recently published on the intermediary formations of Europe. With respect to lydian stone, there can be no doubt that it is contained on some points not yet explored in the clay-slate of Guanaxuato; for I found the former substance frequently imbedded in large fragments in the ancient conglomerate (red sandstone) which covers the clay-slate between Valenciana, Marfil, and Cuevas. Thirty miles to the south of Cuevas, between Queretaro and la Cuesta de la Noria, in the middle of a Mexican table-land, a transition clay-

slate appears beneath the porphyry, darkish-gray, and passing both to siliceous slate *(schistoïd jasper kiesel-schiefer)* and lydian stone. Many fragments of this latter substance are found near the Noria scattered in the fields. The rocks with argentiferous veins of Zacatecas, and a small part of the veins of Catorce, according to the report of two well-informed mineralogists, MM. Sonneschmidt and Valencia, also traverse transition clay-slate, which contains true beds of lydian stone, and which appears to rest on syenites. This super-position would prove, according to what has been observed of the great shaft of Valenciana, that the clay-slates of Mexico constitute (as at Caucasus and in the Cotentin) the same formation with the transition syenites and euphotides, and that perhaps they alternate with the latter rocks.

It is in porphyries and porphyritic greenstones, that at the north of the equator, in Mexico and in Hungary, the immensely rich gold and silver mines have been discovered; for although the metalliferous rock of Schemnitz (*saxum metalliferum* of Born) may perhaps be posterior to the transition lime-stones, containing some indistinct organic remains, this position, in the opinion of a celebrated geognost, M. Beudant, is too uncertain to separate formations so closely allied as those of New Spain and Hungary. The syenites with zircons, the transition granites and porphyries of Norway, which MM. de Buch and Hausmann have made us acquainted

with, are not only posterior, (Stromsoë, Krogskoven) to grauwacke and a clay-slate that alternates with orthoceratite-limestone, but these rocks also cover (Skeen) immediately a quartzite *(quartzfels)* that represents grauwacke, and reposes on a black limestone destitute of alternating beds of clay-slate.

The property which certain porphyries and porphyritic syenites possess of being eminently metalliferous, ought not, I think, to oppose the union of the rocks of Mexico, Hungary, Saxony and Norway. The ores of gold and silver do not form contemporary beds, but are veins of extraordinary size. Some transition porphyries, several of which we should be tempted to place among trachytes because they contain true beds of phonolite with glassy feldspar, participate in these mineral riches, which, among the rocks posterior to primitive formations, were long thought to be found exclusively in carburetted and micaceous clay-slate, grauwacke, and transition limestone. There exist in the same regions groups of porphyries and syenites, very analogous, in their mineralogical composition and their position, to the rocks containing the rich mines of Schemnitz or New Spain, and which, nevertheless, are found entirely destitute of metals. This is the case with almost all the transition porphyries of South America. The great workings of Peru, those of Hualgayoc or Chota, and Llauricocha or Pasco, are not in porphyry, but mountain limestone. The famous Cerro del Potosi, in the republic of Buenos-Ayres,

is composed of clay-slate (transition ?) covered by porphyries that contain disseminated garnets.

If the great argentiferous and auriferous deposits which have formed for ages the wealth of Hungary and Transylvania, are found solely amidst syenites and porphyritic greenstones, we must not thence conclude that the case is the same in New Spain. The Mexican porphyries no doubt offer insulated examples of immense riches. At Pachuca, the pit of del Encino alone furnished annually, during a long time, more than 18,500lbs. troy of silver; in 1726 and 1727, the two workings of La Biscaina and Xacal gave together 333,000lbs. troy; that is, almost twice as much as all Europe and Asiatic Russia produced in the same interval. These same porphyries* of Real del Monte, which are connected by their upper beds with porphyritic trachytes and pearl-stone, with obsidian of Cerro de las Navajas, furnished, by the working of the mine of La Biscaina, to the Count of Regla, from 1762 to 1781, more than 3,384,000*l.* These riches, however, are still inferior to those which are drawn in the same country from transition formations which are not porphyritic. The *veta negra* of Sombrerete, which traverses a compact limestone containing nodules of lydian stone, has furnished the example of the greatest abundance of silver which has been observed

* Porphyry is what is called *Elvan* in Cornwall, where it is usually found to run in channels or courses in the killas or clay-state; in Mexico it forms larger masses.—J. T.

in the two hemispheres; the family of Fagoaga, or of the Marquis del Apartado, drew from thence in a few months a neat profit of 870,000*l*. The produce of the mine of Valenciana, worked in transition slate, has been so constant, that to the end of the last century it never ceased to furnish anually, during forty years successively, above 222,000lbs. troy of silver. In general, in the central part of New Spain, where porphyries are frequent, it is not that rock which affords the precious metals in the three great workings of Guanaxuato, Zacatecas, and Catorce. These three mining districts, which yield the half of all the Mexican gold and silver, are situated between the 18th and 23d degrees of north latitude. The miners there work on metalliferous mineral deposits, almost entirely in intermediary formations of clay-slate, grauwacke, and alpine limestone; I say almost entirely, for the famous *Veta madre* de Guanaxuato, richer than Potosi, and furnishing till 1804, on an average, a sixth of the silver which America pours into the circulation of the whole world, traverses both clay-slate and porphyry. The mines of Belgrado, San Bruno, and Marisanshez, opened in the porphyritic part at the south-east of Valenciana, are but of small importance. Other workings carried on in the porphyries of Real del Monte, Moran, Pachuca, and Bolaños, do not now furnish above 62,000lbs. troy, or a twenty-fifth part of the silver exported (1803) from the port of Vera Cruz. I thought it proper here to state these

facts, because the denomination of *metalliferous porphyries* which I have often used in my works, might lead to the error of considering the metallic riches of the New World as procured in great part from transition porphyries. The more we advance in the study of the constitution of the globe in different climates, the more we are convinced that there scarcely exists one rock anterior to mountain limestone which has not been found in some countries extremely argentiferous. The phenomenon of these ancient veins in which our metallic riches are deposited, (perhaps as the specular iron and muriate of copper are deposited in modern times in the fissures of lava,) is a phenomenon that appears in some degree independent of the specific nature of rocks.

In advancing to the north towards Sopilote, Mescala, and Tasco, we again lose sight of porphyry. Primitive granite re-appears, but is soon hid by a porphyry, the mineralogical composition of which presents very remarkable characters; it is blueish-gray, a little argillaceous by decomposition, and contains large crystals of whitish-yellow feldspar (rather lamellar than glassy), pyroxene of nearly a leek-green, and a little uncrystallized quartz. This stratified porphyry is covered, towards the south, with the same conglomerate limestone that abounds on the table-land of Chilpansingo; towards the north (Sopilote, Estola, Mescala) with a grayish compact limestone traversed by veins of carburet-

ted lime. The limestone of Estola is not always spongy or vesicular in its whole mass, like the formation of Masatlan, but contains large insulated caverns like the limestone of Peregrino. Whilst travelling in those mountains, I had no doubt remaining, that the rocks of Cañada de Sopilote and of Alto del Peregrino are identical with our alpine limestone *(zechstein)* of Europe, which succeeds, according to the age of its formation, to the red sandstone, or, when that is wanting, to the transition rocks. Near Mescala, a little north of Sopilote, rich silver veins, analogous to the veins of Tasco and Tehuilotepec, traverse the alpine limestone. The rock in the valley of Sopilote, that covers the porphyry of the group of Zumpango, exhibits the same sinuous and contorted beds that are seen at Achsenberg, on the bank of the lake of Lucerne, and in other mountains of alpine limestone in Switzerland. I observed that the upper beds of the formation of Sopilote and Mescala passed progressively to whitish-gray, were destitute of veins of calcareous spar, and presented a dull, compact, or conchoidal fracture. They divide, nearly like the limestone of Pappenheim, into very thin layers. It seems to be the passage from the alpine to the Jura limestone, two formations which immediately cover each other in Switzerland, the Apennines, and several parts of equinoctial America, but which in the south of Germany are separated from each other

by several interposed formations (by the sandstone of Nebra, or *bunte sandstein*, by *muschelkalk*, and the white sandstone or *quadersandstein*).

Near the village of Sochipala, the mountain limestone is covered by gypsum, and between Estola and Tepecuacuilco, there appears beneath the mountain limestone (directed sometimes N. 48° E., with inclination of 40° at the east; sometimes N. 48° E.; with inclination 50° to south-east) a porphyry, asparagus-green, with a base of compact feldspar, divided into very thin strata like that of Achichintla, and almost destitute of disseminated crystals. This rock resembles phonolitic porphyry (*porphyr-schiefer*) of the trachyte formation. In advancing towards the mines of Tehuilotepec and Tasco, we find the same rock covered with a quartzose sandstone having a cement of argillaceous limestone, and analogous to the *weiss liegende* (lower arenaceous bed of zechstein) of Thuringia. This quartzose sandstone again announces the proximity of mountain limestone; and in fact, on this sandstone and perhaps immediately on porphyry (as at Zumpango, and the Alto de los Caxones), near the salt lake of Tuspa, an immense mass of mountain limestone reposes, often cavernous, and containing some petrifactions of trochi and other univalve shells. This limestone of Tuspa, indubitably posterior to all the porphyries which I have just described, contains beds of specular gypsum, and beds of slaty and carburetted clay, which we must not confound with

grauwacke-slate. It is generally blueish-gray, compact and crossed by veins of carbonate of lime. In many places, instead of being cavernous, it passes to a very compact white formation, analogous to the limestone of Pappenheim. I was struck with these variations of texture, which M. de Buch and myself had also observed in the Apennines (between Fosombrono, Furli, and Fuligno), and which seem to prove that, where the intermediary members of the series were not developed, the formations of alpine and Jura limestone are more closely connected than is generally admitted. The rich silver veins of Tasco, which formerly yielded 99,000lbs. troy of silver annually, traverse both limestone and a clay-slate that passes to mica-slate; for, notwithstanding the identity of the limestone formations of Tasco and Mescala, which are both argentiferous, the former of those, wherever it has been pierced in mining (Cerro de S. Ignacio), has not been found superposed to porphyry like the limestone of Mescala, but covering a more ancient rock than porphyry, a mica-slate (dir. N. 50° E.; incl. 40°—60°, most frequently at N. W. sometimes at S. E.) destitute of garnets, and passing to primitive clay-slate. It was proper to enter into these details on the formations that succeed porphyries, because it is only in making known the nature of *superposed* rocks, that geognosts can be enabled to decide on the place which Mexican porphyries ought to occupy in the order of formations. A sketch of a geognostic ta-

ble has its value only inasmuch as we connect the rock we wish to make known, to those by which it is immediately succeeded above and below. Mineralogical facts alone may be presented singly; positive geognosy is a science occupied with the relation and connexion of facts; and in describing any one portion of the globe, we ought not to limit our view, and stop at the study of a particular bed.

Central table-land, valley of Mexico; tract between Pachuca, Moran, and La Puebla. An enormous mass of transition porphyry rises to the *mean* height of 1200 to 1400 fathoms above the level of the sea. It is covered in the valley of Mexico, and at the south towards Cuernavaca and Guchilaque, with basaltic and cellular amygdaloid (*tetzontli* in Mexican); and towards the east and north-east (between Tlascala and Totonilco) with secondary formations. The porphyry, probably hid at first beneath the mountain limestone of Mescala and then in the Llanos of San Gabriel (near the bridge of Istla) beneath trachytic conglomerates and a porous amygdaloid, is identical with that which reappears, 45 miles further north, and 800 fathoms higher, on the banks of the lake of Tezcuco. In the fine valley of Mexico the porphyritic rock pierces the cellular amygdaloid in the hills of Chapoltepec, of Notre Dame de la Guadeloupe, and of Peñol de los Baños. It exhibits several very remarkable varieties; 1. reddish-gray, a little argillaceous, with-

out distinct stratification, containing crystals of hornblende, and common feldspar in equal parts (level dug in the rock of Chapoltepec); 2. black or darkish-gray (sometimes fissile and spongy) stratified by beds from 3 to 4 inches thick, with a basis of compact feldspar, fracture dull, smooth, or imperfectly conchoidal, resembling more the fracture of lydian stone than that of pitchstone, containing small crystals of glassy feldspar and olive-green pyroxene, almost destitute of hornblende, and often covered at their surface by superb masses of reniform hyalite, or Muller's glass (Peñol de los Baños; dir. N. 60° W.; incl. 60° N. E.); 3. red, earthy, with a quantity of large crystals of common decomposed feldspar (salt-works of the lake of Tezcuco, where the Peñol is covered by ancient Aztic sculptures). The porphyry of the valley of Mexico furnishes not only springs of pure water, which is conveyed to the town by long and magnificent aqueducts, but also acidulated thermal waters, some warm, and others cold. Here are also found (and this is a very remarkable fact) naphtha and petroleum (promontory of the sanctuary of Guadeloupe), as in the primitive mica-slate of the vicinity of Araya and Cumana. Although this porphyry appears below the porous amygdaloid, and is seen (Cerro de las Cruces and Tiangillo, Cuesta de Varientos and Capulalpan, Cerro Ventoso, and Rio Frio) in all the circular outline of the basin of Tenochtitlan, (the bottom of an ancient lake partly dried,) it is only towards

the north-east (Pachuca, Real del Monte, and Moran) that it has been found to be argentiferous.

Several rich veins traverse a mass of porphyry above 700 feet in thickness, from the mine of San Pedro, at the summit of Cerro Ventoso (1461 fathoms), as far as the bottom of the ancient wells of Encino (1170 fathoms), in the Real de Pachuca. This rock, which would have formerly been called petrosilex, or hornstone-porphyry, is generally greenish-gray, sometimes prase-green, with a scaly fracture, and giving fragments with sharp edges. The paste is probably a compact feldspar, having a large proportion of silica; and contains, not quartz and mica, but crystals of common feldspar and hornblende. In general, the latter substance is not very abundant, and when the porphyry is argillaceous, or merely earthy, we recognise the hornblende only by spots with striated surfaces, and of a very dark green. The beds which are argillaceous and softer (clay porphyry of Moran) appear to be below the harder and more tenacious beds. Strata of phonolite (*klingstein*) are found subordinate to both; it is smoke-gray, or leek-green, divided into tables or plates that are very sonorous. It is not, however, altogether a porphyry-slate of the trachyte formation; for the phonolitic mass does not contain thin crystals of glassy feldspar, but crystals of grayish-white common feldspar, constantly accompanied with a little hornblende. All these argentiferous porphyries of Moran and Real del Monte are very re-

gularly stratified (general direction as in the valley of Mexico, N. 60° W., incl. 50°—60° at N. E.) = they are irregularly columnar only in the Organos of Actopan (Cerro de Mamanchota, summit 1527 fathoms) and the Monjas of Totonilco el Chico; if indeed the rock of Organos, the mass of which is 3000 feet thick, reckoning only the porphyries visible above the neighbouring plains, is identical with the rock of Moran. The latter contains fewer crystals of hornblende; neither of these rocks is fissile or porous, and it is at the foot of the grotesque peaks of Monjas that the rich veins of Tononilco el Chico are found. The argentiferous porphyries of Pachuca and Moran which I have just described, present no character that should separate them from the transition formation: they are even covered, between the baths of Totonilco el Grande and the cavern of Madre de Dios, or the pierced rock, by enormous calcareous masses, and by sandstone and gypsum.

Group of porphyries of Guanaxuato. It is this group that determines most clearly the relative age, or, to express myself with more precision, the *maximum* of the antiquity of the Mexican porphyries; if indeed those of which we have just indicated the positions are of the same formation as the porphyries of Guanaxuato. The superposition of those porphyries on rocks belonging to intermediary formation is evident. Near the farm of Noria, and in the Cañada de Queretaro, a slaty olive-green porphyry, containing glassy feldspar in

microscopic crystals, is superposed on a transition clay-slate with lydian stone. This superposition is equally certain near Guanaxuato, and particularly near Santa Rosa de la Sierra. The porphyries of this district have in general a concordant position (a parallel direction and inclination) with the strata of clay-slate. They are eminently metalliferous; and the famous vein of Guanaxuato *(Veta Madre)*, making the same angle with the meridian as the veins of Zacatecas, Tasco and Moran (N. 50° W.), has been worked successively on a length of 12,000 fathoms, and a thickness of 20 to 25 fathoms. It has furnished, in 230 years, more than 39,000,000*l.*, and traverses both porphyry and transition-slate. The first of these rocks forms, at the east of Guanaxuato, gigantic masses, that have at a distance the most singular aspect, resembling walls and bastions. These perpendicular ridges, rising more than 200 fathoms above the surrounding plains, bear the name of *buffas;* they are destitute of metals, appear to have been heaved up by elastic fluids; and are regarded by the Mexican miners, who see them placed also at Zacatecas on a very metalliferous transition clay-slate, as a natural indication of the riches of those countries. When we consider the porphyries of La Buffa de Guanaxuato, and those of the formerly celebrated mines of Belgrado de San Bruno, la Sierra de Santa Rosa, and Villalpando, in the same point of view, we think we perceive in their latest strata,

passages to rocks which in Europe are generally placed among trachytes.

In the vicinity of Guanaxuato, porphyries predominate, which have a paste of compact feldspar, are gray and olive-green, and contain imbedded lamellar feldspar (not glassy), either in crystals almost microscopic (Buffa) or in very large crystals (mines of San Bruno and Tesoro). Decomposed hornblende, which probably tinges with green the whole mass of these rocks, is only distinguished by irregular spots. In ascending towards the Sierra (Puerto de Santa Rosa, Puerto de Varientos), the porphyry is often composed of balls with concentric layers; its paste becomes darkish-gray, semi-vitreous (pitchstone-porphyry), and contains a little crystallized mica and grains of quartz. The auriferous veins near Villalpando traverse a green porphyry with a base of phonolite, in which we perceive only some small and thin crystals of glassy feldspar. It is difficult to distinguish this rock from trachytic porphyry-slate; I have seen it covered with an earthy yellowish-white porphyry (mine of Santa Cruz), and with an ancient conglomerate (mouth of the mine of Villalpando), which evidently represents the red sandstone, and the lower beds of which pass to grauwacke.

The porphyries of the equinoctial region of Mexico contain, although rarely, besides some disseminated garnets (Izmiquilpan and Xaschi), sulphuret of mercury (San Juan de la Chica; Cerro

del Fraile, near the Villa of San Felipe; Gasave, at the northern extremity of the valley of Mexico), tin (El Robedal, and la Mesa de los Hernandez), and alumstone (Real del Monte, according to M. Sonneschmidt). This latter substance seems to give to the porphyritic rocks a nearer affinity to real trachytes; although in South America (peninsula of Araya, Cerro del Distiladero and Chupariparu) I saw a clay-slate which belonged rather to the primitive than to the intermediary formation, traversed by veins, I will not say, of alumstone (*alumstein*), but of native alum, of which the Indians sell pieces of the size of an inch at the market of Cumana. The cinnabar of the porphyries of San Juan de la Chica, the argillaceous beds of Durasno containing both coal and cinnabar and placed on a porphyry with much hornblende, are phenomena well worthy of attention. The geognosts who, like myself, attach more importance to the position than to the mineralogical composition of rocks, will, no doubt, connect the porphyries and clays of Davasno with the deposites of mercury which the formation of the red sandstone and porphyry exhibits in both hemispheres (duchy de Deuxponts and Cuença, between Quito and Loxa). The last beds of the transition formation are found every where in close connexion with the most ancient beds of the secondary formation.

The celebrated silver vein of Bolaños contains its greatest riches in an amygdaloid interposed in

porphyry. In Hungary, England, Scotland, and even in Germany, rocks of amygdaloid and porphyry belong to grauwacke, to clay-slate, to transition limestone, to red sandstone, and to coal sandstone. The metalliferous porphyry of Guanaxuato simply covers clay-slate, without forming in it subordinate beds; but a syenite analogous to that which occurs in the mine of Valenciana, in the midst of intermediary clay-slate, alternates thousands of times, on a surface of more than twenty square leagues, with transition greenstone, between the mine of the Esperanza and the village of Comangillas. In that region the syenitic rock is destitute of metals, but at Comanja it is argentiferous, as it is also in Saxony and in Hungary.

I had the opportunity of observing the formation of red sandstone in the equinoctial region of the New Continent, north and south of the equator, in six different places; in New Spain (from 1100 to 1300 fathoms high), in the steppes or Llanos of Venezuela (30—50 fathoms), in New Granada (50—1800 fathoms), on the southern table-land of the province of Quito (1350—1600 fathoms), and in the western valley of the Amazon (200 fathoms).

The schists and transition porphyries of Guanaxuato (table-land of Anahuac), of which we have given a detailed description above, are covered with a formation of red sandstone. This formation fills the plains of Celaya, Salamanca, and Burras (900 fathoms); it there supports

limestone very analogous to that of Jura, and lamellar gypsum. It extends by Cañada de Marfil to the mountains that surround the town of Guanaxuato, and appears in insulated spots in the Sierra de Santa Rosa, near Villalpando (1330 fathoms). This Mexican sandstone has the most striking resemblance with the *rothe todte liegende* of Mansfeld in Saxony. It contains angular fragments of lydian stone, syenite, porphyry, quartz, and flint *(splittriger hornstein)*. The cement that unites these fragments is argillo-ferruginous, very tenacious, yellowish-brown, and often (near the river of Serena) of a brick-red colour. Beds of coarse conglomerate, containing fragments two or three inches in diameter, alternate with a fine-grained conglomerate, sometimes even (Cuevas) with a sandstone consisting uniformly of grains of quartz. Coarse conglomerates abound more in plains and ravines than on the heights. I thought I perceived in the most ancient beds (mine of Rayas) a passage from the red sandstone to grauwacke; the pieces of imbedded syenite and porphyry become very small; their outlines are indistinct and appear as if softened into the mass. This conglomerate *(frijolillo de Rayas)* must not be confounded with that of the mine of Animas, which is whitish-gray, and contains fragments of compact limestone. In the red sandstone of Guanaxuato, as well as in that of Eisleben in Saxony, the cement is often so abundant (road from Guanaxuato to

Rayas and Salgado) that the imbedded fragments are no longer distinguished. Argillaceous beds, from three to four inches thick, then alternate with the coarse conglomerate. The great formation of red sandstone, superposed on metalliferous clay-slate, appears in general only when supported by transition porphyry (Belgrade, Buffa de Guanaxuato); but we see it distinctly placed on the latter rock at Villalpando. I found no petrified shells, nor any trace of coal or fossil wood in the red sandstone of Guanaxuato. These combustible substances occur frequently in other parts of New Spain, especially in those which are least elevated above the level of the sea. In the interior of New Mexico, coal is known not far from the banks of the Rio del Norte; other deposites of it probably are hid in the plains of Nuevo Sant-Ander and the Texas. At the north of Natchitoches, near the coal-mine of Chica, subterraneous detonations are heard from time to time, from an insulated hill, occasioned perhaps by the inflammation of hydrogen gas mixed with atmospheric air. Fossil wood is common in the red sandstone that extends towards the north-east of the town of Mexico. It is also found in the immense plains of the intendance of San Luis Potosi, and near the town of Altamira. The coal of Durasno (between Tierra-Nueva and San Luis de la Paz) is placed below a bed of clay containing fossil wood, and over a bed of sulphuret of mercury which covers the porphyry.

Does it belong to very recent lignites? or, ought we not rather to admit that these combustible substances of Durasno, these clays and semi-vitreous porphyries *(pechstein porphyre)*, globular and covered with mammillated hyalite, porphyries which in other parts of Mexico (San Juan de la Chica, Cerro del Fraile near the Villa of San Felipe) contain deposites of sulphuret of mercury, are connected with the great formation of red sandstone? There is no doubt that this formation is as rich in mercury in the new continent as in the west of Germany; it is found there when the porphyries are wanting (Cuença, table-land of Quito); and if the union of veins of tin with veins of cinnabar, in the porphyries of San Felipe, appear at first to remove porphyritic rocks which abound in mercury from those of the red sandstone, we must recollect that transition clay-slate and porphyries (Hollgrund near Steben, Hartenstein) are also sometimes stanniferous in Europe.

I place in the suite of coal-sandstones of Guanaxuato, a formation that is somewhat doubtful, which I have already described, in my *Political Essay on New Spain*, by the name of *lozero*, or feldspathic conglomerate; it is an arenaceous rock, reddish-white, and sometimes apple-green, which divides, like sandstone *(leuben* or *waldplattenstein* of Suhl), in very thin plates *(lozas)*; it contains grains of quartz, small fragments of clay-slate, and a quantity of crystals of feldspar partly

broken and partly entire. These various substances are connected together in the *lozero* of Mexico, as in the rock of porphyritic aspect of Suhl, by an argillo-ferruginous cement (Cañada de Serena, and almost the whole mountain of that name). It is probable that the destruction of the porphyry has had great influence on the formation of the feldspathic sandstone of Guanaxuato. The most experienced mineralogist might at first be led to take it for a porphyry with an argillaceous base, or for a porphyritic breccia. Around Valenciana the *lozero* forms masses of 200 fathoms in thickness, and which exceed in elevation the mountains formed by the intermediary porphyry. Near to Villalpando a feldspathic conglomerate, with very small grains, alternates by beds one or two feet thick, twenty-eight times with slate-clay of a darkish brown. I saw every where this conglomerate or *lozero* reposing on the red sandstone, and at the south-west declivity of Cerro de Serena, in descending towards the mine of Rayas, it appeared to me sufficiently evident that the *lozero* forms a bed in the coarse conglomerate of Marfil. I doubt, consequently, if this remarkable formation can belong to trachytic pumice-conglomerates, as M. Beudant seems to think from its analogy with some rocks in Hungary. The argillaceous cement becomes often so abundant that the imbedded parts are scarcely visible, and the mass passes to compact clay-stone *(thonstein)*. In this

state the *lozero* furnishes the fine building-stone of Queretaro, (quarries of Caretas and Guimilpa,) which is so much esteemed for architecture. I have seen columns fourteen feet high, and two feet and a half in diameter, flesh-red, brick-red, or peach colour. When in contact with the atmosphere those fine colours change to gray, probably by the action of the air on the dendritic manganese contained in the fissures of the rock. The columns of Queretaro have a smooth fracture, like that of the lithographic Jura limestone. With difficulty we discover in these clay-stones *(argilolites)* some very small fragments of clay-slate, quartz, feldspar, and mica. I will not decide, if the unbroken crystals of *lozero* or feldspathic sandstone are developed in the mass itself, or are found there accidentally. I shall here confine myself to the observation, that in Europe this red sandstone and these porphyries are also sometimes characterized by a *local suppression* of crystals and imbedded fragments. The *lozero* appears to me to be a formation of superposed sandstone, perhaps even subordinate to the red sandstone; and if no rock entirely similar is found in the ancient continent, we see, at least, the first germ of this kind of pseudo-porphyritic structure in the layers of sandstone with feldspar crystals, broken or entire, which are sometimes imbedded in the great formation of red sandstone of Mansfeld and Thuringerwald.

Note 1.

An attentive perusal of the preceding observations on the geology of those parts of Mexico which contain the richest mines, will present striking resemblances, in some points, to what is observed in England. It is only within a few years, that the coincidence between the position of the most productive mines of Cornwall, with the junctions of different rocks has been much noticed. My own attention was first called to it by the communication of observations made in different parts of Europe by my friend Mr. Greenough, and I believe I was afterwards instrumental in calling the attention of our practical miners to the circumstance. The truth of the remark is now universally admitted in that district, where it will appear that our great mines are either near the junction of the killas (clay-slate) with the granite, or they are in killas which is intersected by channels of elvan (inclined beds of porphyry). So prevalent is the opinion now become, that some of the most intelligent miners would hesitate to recommend trials which involve much expense, on lodes or veins discovered where the different rocks are not thus associated, or in what has in Cornwall been significantly called a *clean country*.

Our lead mining districts in England are also to be found near junctions, either where the coal measures rest on the limestone, as in North Wales, or where rocks are interstratified, as in Derbyshire, Yorkshire, or Cumberland and Durham.

We see this theory confirmed in Mexico: in the succeeding chapter we shall find that at Guanaxuato the richest veins in the world are in killas, containing beds of syenite, and in porphyries, which we should call elvan; and that the best mines on this extraordinary lode are near the junction of the rocks.

At Sombrerete the lode is in limestone containing lydian stone, a kind of flinty slate nearly allied to chert, which in England is found with the limestone near some of our best lead mines, and is esteemed a favourable circumstance, as it is also at Ecton mine for copper.

In Zacatecas and Catorce, where the mines have been extremely rich, we find them in intermediary formations of clay-

slate, grauwacke and limestone. The veins of Tasco traverse both limestone and clay-slate.

Real del Monte, Moran and Pachuca, which are nearly together, and Bolaños which is very distant from them, exhibit porphyry as the prevalent rock: we observe, however, that it is stratified with beds which are of the argillaceous kind, and that strata of phonolite, which is a kind of basalt or whin stone, occur in them; and that amygdaloid, another rock of the same nature, forms junctions at no great distance.

We cannot too much value the industry and accuracy of the learned author, which have enabled us to compare facts so important, at such a distance from our usual means of information. J. T.

Note 2.

The *lozero* of Guanaxuato, which M. Humboldt places in the suite of coal sandstones, will deserve particular attention on the part of those who may undertake the mines of that important district. It does not indeed appear that any coal has been discovered there; but as this rock seems to resemble some of the sandstones which occur among coal formations, and as fuel for steam-engines and smelting will be an article of the utmost importance, no effort should be spared for its discovery, and no exertion should be abandoned while any chance exists. J. T.

CHAPTER IX.

Geological constitution of mines—position and extent of mineral veins—elevation of mines—comparative wealth of mines—distance between principal mines—nature of ores—mean riches of ores.

As the subject of the disposition of the mineral treasures of Mexico in the bosom of the earth—the direction, inclination, and character of the veins, is of primary importance, we shall communicate the result of some further observations on those interesting phenomena, together with some details as to the comparative wealth of the most celebrated veins.

Those who have studied the geological constitution of a mining country of great extent, know the difficulty of reducing to general ideas the observations made on a great variety of beds and metalliferous veins. These difficulties are increased when it happens, as in the mountains of Mexico, that the *veins*, the *beds*, and the *masses (stockwerke)*, are scattered in an infinity of mixed rocks of very different *formations*. If we possessed an accurate description of the four or five thousand veins actually wrought in Mexico, or which have been wrought within the two last centuries, we

should undoubtedly perceive, in the materials and structure of these veins, analogies indicative of a simultaneous origin; we should find that the matters comprising the veins are partly the same with those which are exhibited in the veins of Saxony and Hungary, and on which M. Werner, the first mineralogist of the age, has thrown so much light. But we are yet very far from being acquainted with the metalliferous mountains of Mexico; and notwithstanding the great number of observations collected by myself in travelling through the country in different directions, for a length of more than 1200 miles, I shall not venture to sketch a general view of the Mexican mines, considered under their geological relations; I shall content myself with merely indicating the rocks which yield the greatest part of the wealth of New Spain.

In the present state of the country, the veins or lodes are the object of the most considerable operations; and the ores disposed in *beds* or in *masses* are not frequent. The Mexican lodes are for the most part found in *primitive* and *transition* rocks, and rarely in the rocks of *secondary* formation.

On taking a general view of the metalliferous repositories, we find that the Cordilleras of Mexico contain veins in a great variety of rocks, and that those rocks, which at present furnish almost the whole silver annually exported from Vera Cruz, are,

primitive slate or killas, *grauwacke*, and *alpine limestone*, intersected by the *principal veins* of Guanaxuato, Zacatecas, and Catorce.

The *porphyries* of Mexico may be considered for the most part as rocks eminently rich in ores of gold and silver. The more we study the geological constitution of the globe on a large scale, the more we perceive that there is scarcely a rock which has not in certain countries been found eminently metalliferous. The wealth of the veins is for the most part totally independent of the nature of the beds which they intersect.

In proportion as the north of Mexico shall be examined by intelligent geologists, it will be perceived that the metallic wealth of Mexico does not exclusively belong to primitive formations and transition rocks, but extends also to those of *secondary formation*. I know not whether the lead which is procured in the eastern parts of the intendancy of San Luis Potosi is found in veins or beds; but it appears certain, that the veins of silver of the Real de Catorce, as well as those of the Doctor and Xaschi near Zimapan, traverse *alpine limestone*; and this rock rests on puddingstone, with siliceous cement, which may be considered as the most ancient of secondary formations. The alpine limestone, and the jura limestone, contain the celebrated silver mines of Tasco and Tehuilotepec, in the intendancy of Mexico; and it is in these calcareous rocks that the numerous

veins which in this country have been very early wrought, display the greatest wealth. Mines in Europe are usually worked either on a great number of small veins, or on fewer depositories of minerals of great size, as at Clausthal, the Harz, and near Schemnitz in Hungary. The Cordilleras of Mexico offer frequent examples of these two methods of operation; but the districts of mines of the most constant and considerable wealth, Guanaxuato, Zacatecas, and the Real del Monte, contain only one principal vein each *(veta madre)*. The vein called *halsbruckner spath*, of which the extent is $6\frac{1}{2}$ feet, and which has been traced for a length of 339 fathoms, is spoken of as a remarkable phenomenon at Freiberg. The *veta madre* of Guanaxuato, from which there have been extracted, during the course of the last ten years, nearly 4,000,000lbs. troy of silver, is of the extent of from 130 to 150 feet, and it is wrought from Santa Isabella and San Bruno to Buena-Vista, a length of more than 6944 fathoms.

In the New Continent the metallic wealth is deposited by nature on the very ridge of the Cordilleras, and sometimes in situations within a very small distance from the limit of perpetual snow. The most celebrated mines in Mexico are at absolute heights of from 5900 to 9840 feet.

We have mentioned in another place the advantage which, in working the Mexican mines, is derived from the most important veins being in a

middle region, where the climate is not unfavourable to agriculture and vegetation. The large town of Guanaxuato is placed in a ravine, the bottom of which is somewhat lower than the level of the lakes of the valley of Tenochtitlan. We are ignorant of the absolute heights of Zacatecas and the Real de Catorce; but these two places are situated on table-lands seemingly more elevated than the level of Guanaxuato. However, the temperate climate of these Mexican towns, which are surrounded with the richest mines in the world, is a contrast to the cold and exceedingly disagreeable climate of Micuipampa, Pasco, Huancavelica, and other Peruvian towns.

The 1,544,000lbs. of silver which are annually sent to Europe and Asia, from the ports of Vera Cruz and Acapulco, are the produce of a very small number of mines. The three districts which we have frequently had occasion to name, Guanaxuato, Zacatecas, and Catorce, supply more than the half of that sum. The vein of Guanaxuato alone yields more than a fourth part of the whole silvero Mexico, and a sixth part of the produce of all America.

The following is the order in which the richest mines of New Spain follow one another, arranging them according to the quantity of money actually drawn from them:

Guanaxuato, in the Intendancy of the same name.

Catorce, in the Intendancy of San Luis Potosi.
Zacatecas, in the Intendancy of the same name.
Real del Monte, in the Intendancy of Mexico.
Bolaños, in the Intendancy of Guadalaxara.
Guarisamey, in the Intendancy of Durango.
Sombrerete, in the Intendancy of Zacatecas.
Tasco, in the Intendancy of Mexico.
Batopilas, in the Intendancy of Durango.
Zimapan, in the Intendancy of Mexico.
Fresnillo, in the Intendancy of Zacatecas.
Ramos, in the Intendancy of San Luis Potosi.
Parral, in the Intendancy of Durango.

The veins of Tasco, Tlapujahua, Sultepeque, Moran, Pachuca, and Real del Monte, and those of Sombrerete, Bolaños, Batopilas, and Rosario, have afforded from time to time immense wealth; but their produce has been less uniform than that of the mines of Guanaxuato, Zacatecas, and Catorce.

The silver extracted in the 37 mining districts into which the kingdom of Mexico or New Spain is divided, is deposited in the *Provincial Treasuries*, established in the chief places of the Intendancies; and it is from the receipts of these *caxas reales* that we are to judge of the quantity of silver furnished by the different parts of the country. The following is an account of the receipts of 11 Provincial Treasuries:

From 1785 to 1789, there were received in the *Caxas Reales* of

	Silver—lbs. troy.
Guanaxuato - - - - - - - -	1,500,000
San Luis Potosi (Catorce, Charcas, San Luis Potosi) - - - - - -	910,000
Zacatecas (Zacatecas, Fresnillo, Sierra de Pinos)	730,000
Mexico (Tasco, Zacualpa, Zultepeque) -	640,000
Durango (Chihuahua, Parral, Guarisamey, Cosiguiriachi) - - - - -	545,000
Rosario (Rosario, Cosala, Copala, Alamos) -	410,000
Guadalaxara (Hostotipaquillo, Asientos de Ybarra) - - - - - -	306,000
Pachuca (Real del Monte, Moran) - -	274,000
Bolaños - - - - - - - - -	219,000
Sombrerete - - - - - -	195,000
Zimapan (Zimapan, Doctor) - - -	150,000
Sum for five years,	5,879,000

That part of the Mexican mountains which at present contains the greatest quantity of silver, is situated between the parallels of 21 and 24½ degrees. The celebrated mines of Guanaxuato are distant, in a straight line, from those of San Luis Potosi, 90 miles only: from San Luis Potosi to Zacatecas the distance is 102 miles; from Zacatecas to Catorce 93, and from Catorce to Durango 222 miles. It is remarkable enough that this metallic wealth of Mexico and Peru should be placed at an almost equal distance in the two hemispheres from the equator.

The silver supplied by the veins of Mexico is

extracted from a great variety of ores, which from the nature of their mixture bear an analogy to those of Saxony, the Harz, and Hungary. The greatest quantity of silver annually brought into circulation, is derived from those ores which the Saxon miner calls by the name of *durre erze*, especially from *sulphuret of silver* (or vitreous silver), from *arsenical (fahlerz)* and *antimonial gray copper*, from *muriate of silver*, from *prismatic black silver*, and from red silver ore. We do not name native silver among these ores, because it is not found in sufficient abundance to admit of any very considerable part of the total produce of the mines of Mexico being attributed to it.

Sulphuret of silver and *black prismatic silver* are very common in the veins of Guanaxuato and Zacatecas, as well as in the *veta Biscaina* of Real del Monte. The silver extracted from the ore of Zacatecas exhibits the remarkable peculiarity of not containing gold. The richest gray copper *(fahlerz)* is that of Sierra de Pinos, and the mines of Ramos. In the latter, the *fahlerz* is accompanied with *glaserz*, with variegated copper ore, sulphuret of zinc, and vitreous copper, which is only wrought for the extraction of the silver, without applying the copper to any use. The antimoniated gray copper described by Mr. Karsten is found at Tasco, and in the mine of Rayas, south-east from Valenciana. The muriate of silver, which is so seldom found in the veins of Europe, is very

abundant in the mines of Catorce, Fresnillo, and the Cerro San Pedro, near the town of San Luis Potosi. That of Fresnillo is frequently of an olive green, which passes into leek-green. Superb specimens of this colour have been found in the mines of Vallorecas, which belong to the district de los Alamos in the intendancy of Sonora. In the veins of Catorce, the muriate of silver is accompanied with molybdate of lead and phosphate of lead. From the last analysis of Mr. Klaproth, it appears that the muriate of silver of America is a pure mixture of silver and muriatic acid, while that of Europe contains oxide of iron, alumine, and especially a little sulphuric acid. The red silver ore constitutes a principal part of the wealth of Sombrerete, Cosala, and Zolaga, near Villalta, in the province of Oaxaca. From this ore more than 425,000lbs. troy of silver have been extracted in the famous mine of *la Veta Negra* near Sombrerete, in the space of from five to six months. It is affirmed that the mine which produced this enormous quantity of metal, the greatest which was ever yielded by any vein on the same point of its *mass*, was not 16 fathoms in length. The true *white silver ore* is very rare in Mexico. Its *grayish white* variety, very rich in lead, is found, however, in the intendancy of Sonora, in the veins of Cosala, where it is accompanied with argentiferous galena, red silver, brown blende, quartz, and sulphate of barytes. This last substance,

GEO. W. CLARKE MEXICO THE TWO REPUBLICS

which is very uncommon among the lodes of Mexico, is to be also found at the Real del Doctor, near Baranca de las Tinajas, and at Sombrerete, particularly in the mine called Campechana. Fluor-spar has been only found hitherto in the veins of Lomo del Toro, near Zimapan, at Bolaños and Guadalcazar, near Catorce. It is constantly of a grass green or violet blue colour.

In some parts of New Spain, the operations of the miner are directed to a mixture of brown oxide of iron and native silver, disseminated in particles imperceptible to the naked eye. This ochreous mixture is the object of considerable operations at the mines of Angangueo, in the intendancy of Valladolid, as well as at Yxtepexi, in the province of Oaxaca. The ores of Angangueo, known by the name of *colorados*, have a clayey appearance. Near the surface, the brown oxide of iron is mixed with native silver, with sulphuret of silver, and black prismatic silver *(sprodglaserz)*, all three in a state of decomposition. At great depths, the vein of Angangueo contains only galena and iron pyrites, yielding but a small quantity of silver. Hence the blackish *pacos*, of the mine of Aurora d'Yxtepexi, which must not be confounded with the *negrillos* of Peru, owe their richness rather to the *glaserz*, than to the imperceptible filaments of native dendritic silver. The vein is very unequal in its produce, sometimes sterile, and sometimes abundant. The *colorados* of Catorce, particularly

those of the mine of Conception, are of a tile-red colour, and mixed with muriate of silver. In general it is observed both in Mexico and Peru, that those oxidated masses of iron which contain silver, are peculiar to that part of the veins nearest to the surface of the earth. The *pacos* of Peru present to the eye of the geologist a very striking analogy with the earthy masses called by the miners in Germany the *iron hat (eiserne huth)* of the veins*.

Native silver, which is much less abundant in America than is generally supposed, has been found in considerable masses, sometimes weighing more than 440lbs. avoird., in the mines of Batopilas in New Biscay. Native silver is constantly accompanied by *glaserz* in the veins of Mexico, as well as in those of the mountains of Europe. These very minerals are frequently found united in the rich mines of Sombrerete, Madroño, Ramos, Zacatecas, Hapujaha and Sierra de Penos. From time to time small branches or cylindrical filaments of native silver are also discovered in the celebrated vein of Guanaxuato; but these masses have never been so considerable as those which

* The ochreous mixtures here described as common in Mexico, Peru and Germany, answer so exactly to the *gossans* of Cornwall that there is no doubt of their being the same; and we have at the mines of Wheal Duchy and Wheal St. Vincent in Calstock in that county, instances of gossan rich in silver, and similar in most respects to the *pacos* and *colorados* above mentioned.—J. T.

were formerly drawn from the mine *del Encino* near Pachuca and Tasco, where native silver is sometimes contained in foliated gypsum. At Sierra de Penos near Zacatecas, this metal is constantly accompanied with blue radiated copper crystallized in small four-sided prisms.

A great part of the silver annually produced in Europe, is derived from the *argentiferous sulphuret of lead*. In Mexico, the greatest part of the veins contain likewise some argentiferous galena; but there are very few mines in which the lead ore is a particular object of their operations. Among the latter, we can only include the mines of the districts of Zimapan, Parral, and San Nicholas de Croix. I observed that at Guanaxuato, as well as several other mines in Mexico*, and every where in Saxony, the varieties of galena contain the more silver, the finer they are in the grain.

A very considerable quantity of silver is produced from the smelting of iron pyrites (*mundic*), of which New Spain sometimes exhibits several varieties richer than the *glaserz* itself. It has been found in the Real del Monte, on the vein of Biscaina, near the pit of San Pedro, the ton of which contained

* Among the varieties of galena, particularly rich in silver, and of very fine grain, may be specified those of the new mine of Talpan, in the Cerro de las Vegas, belonging to the district of Hostotipaquillo. This galena, which sometimes passes into *compact antimonial sulphuret of lead*, is accompanied with much copper pyrites and carbonate of lime.

even so much as 450oz. troy of silver. At Sombrerete, the abundance of pyrites disseminated in the red silver ore, is a great obstacle to the process of amalgamation.

We have described the ores which produce the Mexican silver, and it remains for us to examine into the *mean riches* of these minerals, considering them as all mixed together. It is a very common prejudice in Europe, that great masses of native silver are extremely common in Mexico and Peru, and that in general the mineralized silver ores destined to amalgamation or smelting, contain more ounces of silver to the ton, than the *poor* ores of Saxony and Hungary. Full of this prejudice, I was doubly surprised, on my arrival in the Cordilleras, to find that the number of *poor mines* greatly surpasses those of the mines to which in Europe we give the name of *rich*. A traveller who visits the famous mine of Valenciana in Mexico, after having examined the *metalliferous* repositories of Clausthal, Freiberg, and Schemnitz, can scarcely conceive how a vein, which for a great part of its extent contains the sulphuret of silver disseminated in the lode in almost imperceptible particles, can regularly supply 230,000oz. per month, a quantity of silver equal to the half of what is annually furnished by all the mines of Saxony. It is no doubt true that *blocks* of *native silver* (*papas de plata*) of an enormous weight, have been extracted from the mines of Batopilas in Mexico and Guantahajo in Peru; but

when we study attentively the history of the principal mines of Europe, we find that the *veins* of Kongsberg in Norway, Schneeberg in Saxony, and the famous metallic repository of Schlangenberg in Siberia, have produced masses of much more considerable bulk. We are not in general to judge from the size of the blocks, of the wealth of the mines of different countries. France does not altogether produce more than 5000lbs. troy of silver annually; and yet there are veins in that country (those of *Sainte-Marie-aux-Mines*) from which amorphous masses of native silver have been extracted, of the weight of 66lbs. avoird.

It appears that at the period of the formation of veins in every climate, the distribution of silver has been very unequal; sometimes concentrated in one point, and at other times disseminated in the lode, and allied with other metals. Sometimes in the midst of the poorest ores we find very considerable masses of native silver; a phenomenon which appears to depend on a particular operation of chemical affinities, of whose mode of action and laws we are completely ignorant. The silver, instead of being concealed in galena, or in pyrites in a small degree argentiferous, or of being distributed throughout all the *mass of the vein* over a great extent, is collected into a single mass. In that case the riches of a point may be considered as the principal cause of the poverty of the neighbouring ores; and hence we may conceive why the

richest parts of a vein are found separated from one another by portions of the lode almost altogether destitute of metals.

Although the New Continent, however, has not hitherto exhibited native silver in such considerable blocks as the Old, this metal is found more abundantly in a state of perfect purity in Peru and Mexico, than in any other quarter of the globe. In laying down this opinion, I am not considering the native silver which appears in the form of lamellæ, branches, or cylindrical filaments, in the mines of Guantahajo, Potosi, and Gualgayoc, or in Batopilas, Zacatecas, and Ramos. I found my opinion rather on the enormous abundance of the ores called *pacos* and *colorados*, in which silver is not *mineralized*, but dissemimated in such small particles, that they can only be perceived by means of a microscope*.

The result of the investigations made by Don Fausto d'Elhuyar, the director general of the mines of Mexico, and by several members of the superior council of mines, is, that in uniting together all the silver minerals annually extracted, it would be found

* The most considerable copper mines of England have always owed their importance more to the quantity than the quality of their ores, and experienced men know that it is but delusive to depend upon rich specimens.

Where profit is, however, to be derived by working mines which yield their produce in a disseminated state, the value of good management, and of the application of machinery, becomes the more important, and the results have often proved the most beneficial.—J. T.

from the mixture, that their mean produce is from 0.0018 to 0.0025 of silver, that is to say, in the common language of miners, that one hundred pounds of ore, or 1200 ounces troy, *contain from three to four ounces of silver*. This important result is confirmed by the testimony of an inhabitant of Zacatecas, who had the direction of considerable metallic operations in several districts of mines of New Spain, and who has lately published a very interesting work on the American amalgamation. M. Garces expressly says, "that the "great mass of Mexican ores is so poor, that the "1,878,400lbs. troy of silver annually produced by "the kingdom in good years, are extracted from "500,000 tons of mineral, partly smelted, and "partly amalgamated." According to these numbers, the mean riches would only amount to 48 ounces per ton, a result which differs very much from the assertion of a traveller, very estimable in other respects, who relates that the veins of New Spain are of such extraordinary wealth, tnat the natives never think of working them when the minerals contain less than a third of their weight in silver, or 43lbs. troy per cwt. * As the most erroneous ideas have

* These accounts of the produce of metal from the ores, seem to imply throughout that the calculation is made on the whole mass of stuff drawn out of the mines, and not upon what we should call in England the clean ores. The processes of dressing or washing in Mexico seem to be so imperfect, that by the improvements that would naturally be introduced, the ores would probably be reduced to a very different state; more rich in

been spread through Europe respecting the *contents* of the ores of America, I shall proceed to give a more minute description of the districts of mines of Guanaxuato, Tasco and Pachuca, which I had occasion to visit.

At Guanaxuato, the mine of the Count de la Valenciana produced between the 1st January 1787 and the 11th June 1791, the sum of 1,034,500lbs. troy of silver, which were extracted from 84,368 *montones* of ores. In the table * containing the general state of the mine, a *monton* is estimated at 32 cwt.; from whence it follows that the mean riches of the minerals was twenty years ago 102 ounces of silver per ton. Applying the same calculation to the produce of the single year 1791, we shall find 186 ounces per ton. At this period, when the mine was in the most flourishing condition, in the total mass of ores there were:

produce, though smaller in quantity. Much advantage may be expected from attention to this circumstance.—J. T.

* *Estado de la mina Valenciana, remitido por mano del Excellentiss. Señor virey de Nueva España al Secretario de Estado Don Antonio Valdes.* (Manuscript.) I have followed the numbers contained in the table drawn up by Don Joseph Quixano, the administrator of the Valenciana. A *monton* (a heap of ores reduced to powder) is reckoned at 35 cwt. at Guanaxuato; at 30 at the Real del Monte, Pachuca, Zultepeque, and Tasco; at Zacatecas and Sombrerete, at 20; at Fresnillo at 18; and at 15 at Bolaños. As the wealth of the ore is determined from the *contents of the monton*, the exact knowledge of the measure is of great importance in metallurgical calculations.

	Oz.
$\frac{5}{1000}$ of rich ores *(polvillos* and *xabones)*, containing per ton - - - - - - - -	3360
$\frac{28}{1000}$ of rich ores *(apolvillado)* - - - -	1400
$\frac{92}{1000}$ of rich ores *(blanco bueno)* - - - -	460
$\frac{815}{1000}$ of poor ores *(granzas, tierras ordinarias, &c.)* -	60

The quantity of rich ores was consequently, to that of the poor ores, nearly in the proportion of 3 to 14. The ores which only contained 60 ounces per ton, supplied in 1791 (we are always speaking of the Valenciana mine alone) more than 123,508lbs. troy of silver; while there was a sufficient quantity of rich ores (from 60 to 3,360 ounces per ton) to yield a produce of more than 247,000lbs. troy. At present, the *mean* richness of the whole vein of Guanaxuato may be estimated at 80 ounces of silver per ton of ores. The South West part of the vein, which intersects the mine of Rayas, yields, however, minerals, of which the *contents* generally amount to more than 450 ounces per ton.

In the district of the mines of Pachuca, they divide the produce of the vein of Biscaina into three classes, of which the richness varied in 1803 from 32 to 160 ounces per *monton* of 30 *quintals*. The minerals of the first class, which are the richest, contain from 144 to 160; and those of the second class, from 56 to 80 ounces troy. The poorest ores which form the third class are only computed at 32 ounces of silver per *monton*. The result is, that the *good* contains 100 ounces; the *middling* 80 ounces; and the *worst* about 50 ounces of silver per ton.

In the district of mines of Tasco, the minerals of Tehuilotepec contain in a *tarea* of four *montones* or 5 tons, 15lbs. troy of silver; those of Guautla yield 45; their mean wealth is consequently about 50 ounces of silver per ton of minerals.

It is not then, as has been too long believed, from the intrinsic richness of the ores, but rather from the great abundance in which they are found in the bowels of the earth, and the facility with which they can be wrought, that the mines of America are to be distinguished from those of Europe *. The three districts of mines which we have just alluded to, furnish alone about 500,000lbs. of silver, and from the whole of these data we cannot entertain a doubt that the *mean contents* of the Mexican ores do not amount, as we have already stated, to more than from 60 to 80 ounces of silver per ton. Hence these ores, though somewhat richer than those of Freiberg, contain much less silver than the ores of Annaberg, Johann-Georgenstadt, Marienberg, and other districts of the *Obergebirge* in Saxony. From 1789 to 1799, there have been extracted *communibus annis* from the mines of the district of Freiberg, 7,838 tons, which have yielded 30,230lbs. troy of silver; so that the mean contents

* The silver ores of Peru do not in general appear to be richer than those of Mexico: the *contents* are estimated not by the *monton*, but by the *caxon* (chest), which contains 24 cargas, reckoning each carga at ten *arrobas* or 250lbs. At *Potosi*, the *mean* richness of the minerals is $\frac{53}{100}$; in the mines of Pasco, $1\frac{1}{20}$ ounces per 100lbs.

were 25 ounces per ton of minerals. But in the mines of the *Obergebirge* the mean riches have amounted to 200, and at very fortunate periods even to 300 ounces per ton.

We have thus taken a general view of the rocks in which the principal mines of New Spain are found; we have examined on what points, in what latitudes, and at what elevations above the level of the sea, nature has collected the greatest quantity of metallic wealth; and we have indicated the ores which furnish the immense quantity of silver which annually flows from the one continent to the other. It remains for us to afford some details relative to the most considerable mining operations. We shall confine ourselves to three of these *groups of mines* which we have already described, to the central group, and those of Tasco and Biscaina. Those who know the state of mining in Europe will be struck with the contrast between the great mines of Mexico, for example, those of the Valenciana, Rayas, and Tereros, and the mines which are considered as very rich in Saxony, the Harz, and Hungary. Could the latter be transported to the midst of the great works of Guanaxuato, Catorce, or the Real del Monte, their wealth, and the quantity of their produce, would appear as insignificant to the inhabitants of America, as the height of the Pyrenees compared with the Cordilleras.

CHAPTER X.

Number of mines—laws respecting mines—quantity of silver raised—state of mining operations—condition of mines—smelting—amalgamation.

The kingdom of Mexico in its present state contains nearly 500 places (*reales y realitos*) celebrated for the mines in their environs. It is probable that these 500 *reales* comprehend nearly three thousand mines (*minas*), designating by that name the whole of the subterraneous works which communicate with one another, by which one or more metallic depositories are worked. These mines are divided into 37 districts, over which are placed the same number of Councils of Mines, called *Diputaciones de Mineria.*

In taking a general view of the mineral wealth of New Spain, far from being struck with the value of the actual produce, we are astonished that it is not much more considerable. It is easy to foresee that this branch of public industry will continue augmenting as the country shall become better inhabited, as the smaller proprietors shall obtain greater security for good government and for the enjoyment of property, and as geological and chemical knowledge shall become more generally diffused. Several obstacles have already been re-

moved since the year 1777, or since the establishment of the supreme council of mines, which has the title of *Real Tribunal general del importante cuerpo de Mineria de Nueva España*, and holds its sittings in the palace of the Viceroy at Mexico. Till that period the proprietors of mines were not united into a corporation, or the Court of Madrid, at least, would not recognise them as an established body by a constitutional act.

The legislation of the mines was formerly in infinite confusion, because, at the beginning of the conquest, under the reign of Charles the Fifth, a mixture of Spanish, Belgic, and German laws was introduced into Mexico; which laws, from the difference of local circumstances, were inapplicable to those distant regions. The erection of the supreme council of mines, the head of which bears a name celebrated in the annals of chemical science, was followed by the establishment of the school of mines, and the compilation of a new code of laws, published under the title of *Ordonanzas de la Mineria de Nueva España*. The council or *Tribunal general* is composed of a director, two deputies from the body of miners, an assessor, two consultors, and a judge, who is head of the *juzgado de alzadas de mineria*. On the *Tribunal general* depend the thirty-seven *councils of provincial mines* or *diputaciones de mineria*, of which the names have been already mentioned. The proprietors of mines (*mineros*) send their representatives to the

provincial councils, and the two general deputies who reside at Mexico, are chosen from among the deputies of the districts. The body of miners of New Spain has, besides, *apoderados*, or representative proprietors at Madrid, whose business it is to treat immediately with the ministry, as to the interest of the colonies, in whatever respects the mines. The students of the *colegio de mineria*, instructed at the expense of the state, are distributed by the *Tribunal* among the head towns of the different *diputaciones*. It cannot be denied that the representative system followed in the new organization of the body of Mexican miners, possesses great advantages. It preserves public spirit in a country where the citizens, scattered over an immense surface, do not sufficiently feel the community of their interests ; and it gives the supreme council a facility of collecting considerable sums, whenever any great or useful undertaking is proposed. It is to be desired, however, that the director of the *tribunal* should possess more influence on the progress of the operations in the provinces, and that the proprietors of mines, less jealous of what they call their liberty, were more enlightened as to their true interests.

The *Supreme Council* possesses an income of more than 40,000*l.* sterling. The king granted it on its establishment two thirds of the royal right of signiorage, which amounts to a *real de plata*, or about sixpence per troy ounce of silver delivered in to the

mint. This revenue is destined for the salaries of the members of the *tribunal*, the support of the school of mines, and to raise a fund for assistance or advances (*avios*) to the proprietors of the mines. These advances, as we have already observed, have been given with more liberality than discernment. A miner of Pachuca at one time obtained 36,000*l.*; and the share-holders of the *mina de agua* of Temascaltepec, received 46,400*l.*; but this assistance never produced any results. The tribunal during the last years of the war of Spain with France and England, was compelled to make a gratuitous present to the court of Madrid, of 104,200*l.*, and to lend it 625,000*l.* besides, 250,000*l.* of which have never been repaid. To support these extraordinary expenses, they were compelled to have recourse to borrowing; and at present the half of the revenues of the supreme council of mines is employed in paying the interest of that capital. They have increased by one half the *signorial impost*, till the period of the liquidation of the debts contracted by the tribunal; and in place of thirteen grains, the miners are obliged to pay twenty per ounce of silver. In this state of things the tribunal can no longer make advances to the miners, who for want of funds are frequently unable to carry on useful undertakings. Great capitals formerly employed in mining, are now destined to agriculture, and the proprietors of mines would again require those establishments (*bancos de plata, compañias refac-*

cionarias ò de habilitacion y avios*) which advanced to the miners considerable sums of money at a large interest.

All the metallic wealth of the Spanish colonies is in the hands of individuals. The Government possesses no other mine than that of Huancavelica in Peru, which has been long abandoned; it is not even proprietor of the great levels, as several sovereigns of Germany are.

From the information given by us in this chapter, it is almost unnecessary to agitate the question, whether the produce of the silver mines of Mexico has attained its *maximum*, or whether there is any probability that it will still augment in the time to come. We have seen that three mining districts, those of Guanaxuato, Catorce, and Zacatecas, alone furnish more than the half of the whole silver of New Spain, and that nearly one fourth of it is furnished by the mine of Guanaxuato. One mine which has only been known for forty years, that of Valenciana, has sometimes alone furnished in one year as much silver as the whole kingdom of Peru. It is but thirty years since the veins of the Real de Catorce began to be worked, and yet by the discovery of these new mines the metallic produce of Mexico was increased nearly one sixth. If we consider the vast extent of ground occupied by the

* *Real cedula sobre la compañia refaccionaria propuesta por el Genoves Domingo Reborato, del* 12 *Marzo* 1744.—*Don Josef Bustamente, Informe sobre la habilitacion de los Mineros,* 1748.

Cordilleras, and the immense number of mineral depositories which have never yet been attempted *, it is very possible that New Spain, under a better administration, and inhabited by an industrious people, may alone one day yield, in gold and silver, the 15,600,000*l.*, at present furnished by the whole of America. In the space of a hundred years, the annual produce of the Mexican mines rose from one to four millions sterling. If Peru does not exhibit an equal augmentation of wealth, it is because this unfortunate country has not increased its population, and because, being worse governed than Mexico, industry found more difficulties to overcome. Besides, nature has deposited the precious metals in that country at enormous elevations, in situations where, on account of the very high price of provisions, the working becomes extremely expensive. The abundance of silver is in general such in the chain of the Andes, that when we reflect on the number of mineral depositories which remain untouched, or which have been very superficially wrought, we are tempted to believe, that the Europeans have as yet scarcely begun to enjoy the inexhaustible fund of wealth contained in the New World. When we cast our eyes over the mining district of Guanaxuato, which, on the small space of a few thousand square yards, supplies annually the seventh or eighth part of all the American sil-

* Especially from Bolaños to the Presidio de Fronteras.

ver, we shall see that the 340,000lbs. troy, which are annually extracted from the famous *veta madre*, are the produce of only two mines, the Valenciana and that of the Marquis de Rayas, and that more than four-fifths of this vein have never yet been attempted. It is very probable, however, that in uniting the two mines of Fraustros and Mellado, and clearing them out, a mine would be found of equal wealth with that of Valenciana. The opinion that New Spain produces only perhaps the third part of the precious metals which it could supply under happier political circumstances, has been long entertained by all the intelligent persons who inhabit the principal districts of mines of that country, and is formally announced in a Memoir presented by the deputies of the body of miners to the King in 1774, a production drawn up with great wisdom and knowledge of local circumstances. Europe would be inundated with precious metals, if they were to work at the same time, and with all the means afforded by the improvements in the art of mining, the mineral depositories of Bolaños, Batopilas, Sombrerete, Rosario, Pachuca, Moran, Zultepec, Chihuahua, and so many others which have been long and justly celebrated. I am aware, that in thus expressing myself, I am in direct contradiction with the authors of a great number of works of Political Economy, in which it is affirmed that the mines of America are partly exhausted, and partly too deep to be worked any longer with advantage. It is true,

no doubt, that the expenses of the mine of Valenciana have doubled in the space of ten years, but the profits of the proprietors have still remained the same; and this increase of expense is much more to be attributed to the injudicious direction of the operations than to the depth of the shafts.

When we take a general view of the mining operations of New Spain, and compare them with those of the mines of Europe, we are surprised at still finding in its infancy an art which has been practised in America for three centuries, and on which, according to the vulgar prejudice, the prosperity of these ultramarine establishments depends.

Since the brilliant period of the reign of Charles the Fifth, Spanish America has been separated from Europe, with respect to the communication of discoveries useful to society. The imperfect knowledge which was possessed in the 16th century relative to mining and smelting, in Germany, Biscay, and the Belgic provinces, rapidly passed into Mexico and Peru, on the first colonizaion of these countries; but since that period, to the reign of Charles the Third, the American miners have learned hardly any thing from the Europeans, but the blasting with powder * those rocks which resist the effect of tools.

German miners have since been sent, at the expense of the Court, to Mexico, Peru, and the king-

* This art was only introduced into the mines of Europe towards the year 1613. (*Daubuisson*, t. i. p. 95.)

dom of New Granada; but their knowledge has been of no utility, because the mines of Mexico are considered as the property of the individuals, who direct the operations, without the Government being allowed to exercise the smallest influence.

We shall not here undertake to detail the defects which we believe we have observed in the administration of the mines of New Spain, but shall confine ourselves to general considerations, remarking whatever appears to us worthy of fixing the attention of the European traveller. In the greatest number of the Mexican mines the operations with the *pointrole*, a sort of wedge somewhat resembling that called by Cornish miners the *gad*, which requires the greatest address on the part of the workman, are very well executed. The *mallet* might indeed be somewhat less heavy; it is the same tool which the German miners used in the time of Charles the Fifth. Small moveable forges are placed in the interior of the mines, to re-forge the point of the pointroles when they are unfit for working. I reckoned 16 of these forges in the mine of Valenciana; and in the district of Guanaxuato the smallest mines have at least one or two. This arrangement is very useful, particularly in mines which employ as many as 1500 workmen, and in which there is consequently an immense consumption of steel. I cannot say much in praise of the method of blasting with powder. The holes for the reception of cartridges are generally too deep, and the

miners are not sufficiently careful in diminishing the mass of rock intended to yield to the explosion. A great waste of powder is consequently occasioned by these defects. The mine of Valenciana consumed *, from 1794 to 1802, powder to the amount of 150,000*l.*, and the mines of New Spain annually require from 12 to 14,000 cwt. It is probable that two-thirds of this quantity is uselessly employed.

The timber-work is very carelessly performed, though it ought the more to engage the consideration of the proprietors, as wood is every year becoming more scarce on the table-land of Mexico. The masonry employed in the shafts and levels †, and especially the walling with lime, deserves great praise. The arches are formed with great care, and in this respect the mines of Guanaxuato may stand a comparison with whatever is most perfect at Freiberg and Schemnitz. The shafts, and still more the galleries or levels, have generally the defect of being dug of too great dimensions, and of occasioning, by that means, exorbitant expenses. We find levels at

* In 1799, 13,731*l.* sterling; in 1800, 14,840*l.* sterling; in 1801, 16,953*l.* sterling; in 1802, 17,312*l.* sterling. The miner is paid at Guanaxuato, for a hole of 4 feet 11 inches in depth, ten shillings; for a hole of 6 feet 3 inches in depth, 7*s.* 6*d.*; without including powder and tools, which are furnished to him. In the mine of Valenciana, nearly 600 holes *by two men each* are made every 24 hours.

† Especially in the mines of Valenciana, Guanaxuato, and the Real del Monte.

Valenciana*, executed with the viewof making trial on a poor vein, of a height of 26 or 29 feet. It is an erroneous opinion, that this great height facilitates the renovation of the air; the ventilation depends on the equilibrium and difference of temperature between two neighbouring columns of air. They believe also, equally without foundation, that, in order to discover the nature of a powerful vein, very large drifts are requisite, as if, in mineral veins of from six to eight fathoms in width, it were not better to cut from time to time small cross drifts, for the purpose of discovering whether the mass of the vein begins to grow richer. The absurd custom of cutting every level of such enormous dimensions, prevents the proprietors from multiplying the means of trial, so indispensable for the preservation of a mine and the duration of the works. At Guanaxuato, the breadth of the oblique shafts dug stairwise is from five to six fathoms; and the perpendicular shafts are generally three, four, or five fathoms in diameter. The enormous quantity of ores extracted from the mines, and the necessity of working in them the ropes attached to six or eight whims, necessarily occasion the shafts of Mexico to be made of greater dimensions than those of Germany; but the attempt which has been made at Bolaños to separate by beams the ropes of the whims, has sufficiently proved that the breadth of the shafts may be

* Canon de la Soledad.

diminished without any danger of the ropes entangling in their oscillatory motion. It would in general be very useful to make use of kibbles instead of leathern bags suspended by ropes for the extraction of the ores.

The greatest fault observable in the mines of New Spain, and which renders the working of them extremely expensive, is the want of communication between the different works. They resemble ill-constructed buildings, where, to pass from one adjoining room to another, we must go round the whole house. The mine of Valenciana is justly admired on account of its wealth, the magnificence of its walling, and the facility with which it is entered by spacious and commodious stairs; yet it exhibits only a union of small works irregularly conducted; they are as it were *cul de sacs*, and without any lateral communication. I mention this mine, not because it is more faulty than the others in the distribution of its labours, but because we might naturally suppose it to be better organized. As subterraneous geometry had been entirely neglected in Mexico, till the establishment of the School of Mines, there is no plan in existence of the works already executed. Two works in that labyrinth of cross levels and interior winzes, may happen to be very near each other, without its being possible to perceive it. Hence the impossibility of introducing, in the actual state of most of the mines of Mexico, the wheeling by means of barrows, and an economical disposition of the

ore plats. A miner brought up in the mines of Freiberg, and accustomed to see so many ingenious means of conveyance practised, can hardly conceive that in the Spanish colonies, where the ores are poor though very abundant, all the metal which is taken from the vein is carried on the backs of men. The Indian *tenateros*, who may be considered as the beasts of burden of the mines of Mexico, remain loaded with a weight of from 250 to 380 pounds for a space of six hours. In the levels of Valenciana and Rayas, they are exposed, as we have already observed in speaking of the health of the miners, to a temperature of from 71° to 77° Fahr.; and during this time they ascend and descend several thousands of steps in shafts of an inclination of 45°. These *tenateros* carry the minerals in bags *(costales)* made of the thread of the *pité*. To prevent their shoulders from being hurt, (for the miners are generally naked to the middle) they place a woollen covering *(frisida)* under this bag. We met in the mines files of fifty or sixty of these porters, among whom there are men above sixty, and boys of ten or twelve years of age. In ascending the stairs they throw the body forwards, and rest on a staff, which is generally not more than a foot in length. They walk in a zigzag direction, because they have found from long exerience, as they affirm, that their respiration is less impeded when they traverse obliquely the current of air which enters the pit from without.

We cannot sufficiently admire the muscular

strength of the Indian and Mestizo *tenateros* of Guanaxuato, especially when we ourselves are oppressed with fatigue in ascending from the bottom of the mine of Valenciana, without carrying the smallest weight. The *tenateros* cost the proprietors of Valenciana more than 620*l.* weekly; and they reckon that there are three men destined to carry the ores to the depositaries to one workman *(barenador)* who blows up the vein by means of powder. These enormous expenses of transportation would perhaps be diminished exceedingly, if the works communicated with each other by winzes, or by levels adapted for conveyance by wheel-barrows or rail-roads, Well contrived operations would facilitate the extraction of minerals and the circulation of air, and would render unnecessary this great number of *tenateros*, whose strength might be employed in a manner more advantageous to society, and less hurtful to the health of the individual. Winzes communicating from one gallery to another, and serving for the extraction of ores, might be provided with windlasses to be wrought by men, or whims to be moved by cattle. For a long time (and this arrangement undoubtedly deserves the attention of the European miner) mules have been employed in the interior of the mines of Mexico. At Rayas these animals descend every morning without guides and in the dark, the steps of a shaft of an inclination of from 42° to 46°. The mules distribute themselves of their own accord in the different places

where the machines for drawing water are fixed — and their step is so sure, that a lame miner was ac — customed several years ago, to enter and leave the mine on one of their backs. In the district of the mines of Peregrino, at the *Rosa de Castilla*, the mules sleep in subterraneous stables, like the horses which I saw in the famous rock salt mines of Wieliczka in Gallicia.

The smelting and amalgamation works of Guanaxuato and Real del Monte are so placed, that two navigable levels, with their openings near Marfil and Omitlan, might serve for the carriage of ores, and render every sort of draught above this level superfluous. Besides, the descents from Valenciana to Guanaxuato, and from Real del Monte to Regla, are so rapid, that they would admit of the construction of rail-ways, on which waggons loaded with the ores destined for amalgamation might be easily rolled along.

We have already spoken of the truly barbarous custom of drawing off the water from the deepest mines, not by means of pump apparatus, but by means of bags attached to ropes which roll on the cage of a whim. The same bags are used in drawing up the water and the ores: they rub against the walls of the shafts, and it is very expensive to keep them in repair. At the Real del Monte, for example, these bags only last seven or eight days; and they commonly cost five, and sometimes seven and eight shillings a piece. A bag full of water, sus-

pended to the cage of a whim with eight horses, *(malacate doble)* weighs 1250 pounds: it is made of two hides sewed together. The bags used for the whims called *simple*, those with four horses *(malacates sencillos)* are only half the size, and are made of one hide. In general the construction of the whims is extremely imperfect; the bad custom also prevails of forcing the horses, by which they are made to go at far too great a speed. I found this speed at the shafts of San Ramon at Real del Monte no less than ten feet and a half per second; at Guanaxuato in the mine of Valenciana from thirteen to fourteen feet; and every where else I found it more than eight feet. Don Salvado Sein, Professor of Natural Philosophy at Mexico, has proved in a very excellent paper on the rotatory motion of machines, that, notwithstanding the extreme lightness of the Mexican horses, they produce only the *maximum* of effect on the whims, when exerting a force of 175 pounds they walk at a pace of from five to six feet in the second.

It is to be hoped that pumps, moved either by horse-engines of a better construction, or by water wheels, or by pressure engines, will at last be introduced in the mines of New Spain If wood and coal, which has only yet been discovered in New Mexico, should be found sufficiently abundant for employing the steam-engine, the use of it would be of great advantage in the inundated mines of Bolaños, as well as in those of Rayas and Mellado.

It is in the draining the mines of water that we particularly feel the indispensable necessity of having plans drawn up by subterraneous surveyors *(geometres)*. Instead of stopping the course of the water, and bringing it by the shortest road to the shaft where the machines are placed, they frequently direct it to the bottom of the mine, to be afterwards drawn off at a great expense. In the district of mines of Guanaxuato nearly two hundred and fifty workmen perished in the space of a few minutes on the 14th of June 1780; because, not having measured the distance between the works of San Ramon and the old works of *Santo Christo de Burgos*, they had imprudently approached this last mine while carrying on a drift in that direction. The water of which the works of Santo Christo were full, flowed with impetuosity through this new gallery of San Ramon into the mine of Valenciana. Many of the workmen perished from the sudden compression of the air, which, in taking vent, threw to great distances pieces of timber, and large masses of rock. This accident would not have happened, if, in regulating the operations, they could have consulted a plan of the mines.

After the picture which we have just drawn of the actual state of the mining operations, and of the bad management which prevails in the mines of New Spain, we cannot be astonished at seeing works which for a long time have been most productive, abandoned whenever they reach a considerable depth,

or whenever the veins appear less abundant in metals. We have already observed, that in the famous mine of Valenciana, the annual expenses rose in the space of fifteen years from 90,000*l.* to 180,000*l.* sterling. Indeed, if there be much water in this mine, and if it require a number of whims to draw it off, the profit must, to the proprietors, be little or nothing. The greater part of the defects in the management which I have pointed out, have been long known to a respectable and enlightened body, the *Tribunal de Mineria* of Mexico, to the professors of the School of Mines, and even to several of the native miners, who, without having quitted their country, know the imperfection of the old methods: but we must repeat here, that changes can only take place very slowly among a people who are not fond of innovations. It is a prejudice to imagine, that the wealth of the mines of New Spain renders unnecessary the intelligence and the economy which are requisite in other mines. We must not confound the abundance of ores with their intrinsic value. The most part of the ores of Mexico being low in produce, as all those who do not allow themselves to be dazzled by false calculations well know, an enormous quantity of stuff impregnated with metals must be extracted, in order to produce 1,540,000lbs. troy of silver. Now it is easy to conceive that in mines of which the different works are badly disposed,

and without any communication with one another, the expense of extraction must be increased in an alarming manner, in proportion as the shafts *(pozos)* increase in depth, and the levels *(cañones)* become more extended.

The working of the mines has long been regarded as one of the principal causes of the depopulation of America. It would be difficult to deny, that at the first epoch of the conquest, and even in the seventeenth century, many Indians perished from the excessive labour to which they were compelled in the mines. They perished without posterity, as thousands of African slaves annually perish in the West Indian plantations from fatigue, want of nourishment and of sleep. In Peru, at least in the most southern part, the country is depopulated by the mines, because the barbarous law of the *mita* is yet in existence, which compels the Indians to remove from their homes into distant provinces, where hands are wanted for extracting the subterraneous wealth.

In the kingdom of New Spain, at least within the last thirty or forty years, the labour of the mines is free; and there remains no trace of the *mita*, though a justly celebrated author* has advanced the contrary. No where do the people enjoy in greater security the fruit of their labours

* Robertson, History of America, vol. ii. p. 373.

than in the mines of Mexico; no law forces the Indian to choose this species of labour, or to prefer one mine to another; and when he is displeased with the proprietor of the mine, he may offer his services to another master who may pay perhaps more regularly. These unquestionable facts are very little known in Europe. The number of persons employed in subterraneous operations, who are divided into several classes *(Barenadores, Faeneros, Tenateros, Bareteros)*, does not exceed in the whole kingdom of New Spain 28 or 30,000. Hence there is not more than $\frac{1}{100}$ of the whole population immediately employed in the mines.

The mortality among the miners of Mexico is not greater than what is observed among the other classes. We may easily be convinced of this by examining the bills of mortality in the different parishes of Guanaxuato and Zacatecas. This is a phenomenon, so much the more remarkable, as the miner in several of these mines is exposed to a temperature 11° above the mean temperatures of Jamaica and Pondicherry. I found Fahrenheit's thermometer at 93° at the bottom of the mine of Valenciana *(en los planes)*, a perpendicular depth of 1681 feet, while at the mouth of the pit in the open air, the same thermometer sinks in winter to 39° or 40°. The Mexican miner is, consequently, exposed to a change of temperature of more than 54°. This enormous heat of the Valenciana mine is not the effect of a great number of men and

lights collected into a small space; it is much more owing to local and geological causes.

It is curious to observe how the Mestizoes and Indians called *tenateros*, employed in carrying minerals on their backs, remain for six hours at a time loaded with a weight of from 225 to 350 pounds, and constantly exposed to a very high temperature, ascending without intermission eight or ten times successively, stairs of 1800 steps. The appearance of these robust and laborious men would have wrought a change in the opinions of the Raynals, Pauws, and many other authors, who have declaimed against the degeneracy of our species in the torrid zone. In the Mexican mines, lads of seventeen years of age are able to carry masses of stone of a hundred pounds weight. This occupation of *tenateros* is accounted unhealthy, if they enter more than three times a week into the mines. But the labour which rapidly ruins the most robust constitutions is that of the *barenadores*, who blow up the rock with powder. These men rarely pass the age of 35, if from a thirst of gain they continue their severe labour for the whole week. They generally pass no more than five or six years at this occupation, and then betake themselves to other employments less injurious to health.

The art of mining is daily improving, and the pupils of the School of Mines at Mexico gradually diffuse correct notions respecting the circulation of

air in pits and galleries. Machines are beginning to be introduced, in place of the old method of carrying minerals and water on men's backs up stairs of a rapid ascent. In proportion as the mines of New Spain resemble more and more those of Europe, the miner's health will be less injured by the influence of the foul air, and the excessively prolonged efforts of muscular motion.

From five to six thousand persons are employed in the amalgamation of the minerals, or the preparatory labour. A great number of these individuals pass their lives in walking barefoot over heaps of brayed metal, moistened and mixed with muriate of soda, sulphate of iron, and oxide of mercury, by the contact of the atmospheric air and the solar rays. It is a remarkable phenomenon to see these men enjoy the most perfect health. The physicians who practise in places where there are mines unanimously assert, that the nervous affections, which might be attributed to the effect of an absorption of oxide of mercury, very rarely occur. At Guanaxuato part of the inhabitants drink the very water in which the amalgamation has been purified *(aqua de lavaderos)* without feeling any injury from it. This fact has often struck Europeans not intimately acquainted with the principles of chemistry. The water is at first of a grayish-blue colour, and contains in suspension black oxide of mercury, and small globules of native mercury and amalgamation of silver. This metallic mixture

gradually precipitates, and the water becomes limpid. It can neither dissolve the oxide of mercury nor the muriate of mercury, which is one of the most insoluble salts we know. The mules are very fond of this water, because it contains a little muriate of soda in solution.

We have already said, that the labour of a miner is entirely free throughout the kingdom of New Spain. No Indian or Mestizo can be compelled to devote himself to the working of mines. It is absolutely false, though the assertion has been repeated in works of the greatest estimation, that the Court of Madrid sends out galley slaves to work in the gold and silver mines. The mines of Siberia have been peopled by Russian malefactors, but in the Spanish colonies this species of punishment has been fortunately unknown for centuries. The Mexican miner is the best paid of all miners; he earns at the least from 1*l.* to 1*l.* 4*s.* per week of six days, while the wages of labourers who work in the open air, husbandmen for example, are 6*s.* 3*d.* on the central table-land, and 7*s.* 6*d.* near the coast. The miners, *tenateros* and *faeneros*, occupied in transporting the minerals to the plats *(despachos)*, frequently gain more than 4*s.* 10*d.* per day of six hours. Honesty is by no means so common among the Mexican as among the German or Swedish miners; they make use of a thousand tricks to steal rich specimens of ores. As they are almost naked, and are searched on

MEXICO
THE TWO REPUBLICS

leaving the mine in the most indecent manner, they conceal small morsels of native silver, or red sulphuret and muriate of silver, in their hair, under their arm-pits, and in their mouths. It is a most shocking spectacle to see in the large mines of Mexico, hundreds of workmen, among whom there are a great number of very respectable men, all compelled to allow themselves to be searched on leaving the shaft or level. A register is kept of the minerals found in the hair, in the mouth, or other parts of the miners' bodies. In the mine of Valenciana at Guanaxuato, the value of these stolen minerals amounted between 1774 and 1787 to the sum of 63,000*l.* sterling.

In the interior of the mines much care is employed in controuling the *tenateros*, by whom the ores are carried towards the shaft from the place of operation. At Valenciana, for example, they know to within a few pounds the quantity of work containing ore which daily goes out of the mine. I say, the work, for the rock is never there an object of extraction, and is employed to fill up the vacancies formed by the extraction of the minerals. At the plats of the great shafts, two chambers are dug in the wall, in each of which two persons *(despachadores)* are seated at a table, with a book before them containing the names of all the miners employed in the carriage. Two balances are suspended before them, near the counter. Each *tenatero* loaded with ores presents himself at the

counter; and two persons stationed near the balances judge of the weight of this load by raising it lightly up. If the *tenatero*, who on the road has had time to estimate his load, believes it lighter than the *despachador*, he says nothing, because the error is advantageous to him; but on the other hand, if he believes the weight of the ore he carries in his bag to be greater than it is estimated, he demands that it should be weighed, and the weight which is thus determined is entered in the book of the *despachador*. From whatever part of the mine the *tenatero* comes, he is paid at the rate of one *real de plata** for a load of $2\frac{1}{4}$ cwt., and one *real* and a half for a load of $3\frac{1}{4}$ cwt. per journey. There are some *tenateros* who perform in one day from eight to ten journeys, and their pay is regulated from the book of the *despachador*. This mode of reckoning is no doubt highly deserving of praise; and we cannot sufficiently admire the celerity, the order, and the silence with which they thus determine the weight of so many thousand quintals of ores, which are furnished by veins of 6 or 8 fathoms in breadth, in a single day.

These ores, which are separated from the sterile rocks in the mine itself by the master miners *(quebradores)*, undergo three sorts of preparation, viz. at the places for jigging or washing the ores, where women work; under the stamping mills; and under the *tahonas* or *arastras*. These tahonas

* Sixpence-halfpenny.

are machines in which the work is ground under very hard stones, which have a rotatory motion, and weigh upwards of seven or eight cwt. They are not yet acquainted with washing with the tub (*setz wüsche*), nor washing on sleeping tables *(tables dormantes) (liegende-heerde)*, or percussion *(stossheerde)*. The preparation under the stumps *(mazos)* or in the *tahonas*, to which I shall give the name of *edge mills*, on account of their resemblance to some oil and snuff mills, differs according as the ore is destined to be smelted or amalgamated. The mills properly belong only to this last process; however, very rich metallic grains called *polvillos*, which have passed through the trituration of the tahona, are also smelted.

The quantity of silver extracted from the ores by means of mercury, is in the proportion of $3\frac{1}{2}$ to 1 of that produced by smelting. This proportion is taken from the general table formed by the provincial treasuries, from the different districts of mines of New Spain. There are, however, some of those districts, for example those of Sombrerete and Zimapan, in which the produce from smelting exceeds that of amalgamation.

Silver *(plata quintada)* extracted from the Mines of New Spain, from the 1st January 1785 to the 31st December 1789.

Provincial treasuries receiving the fifth.	Silver extracted by amalgamation.	Silver extracted by smelting.
Mexico	950,185	104,835
Zacatecas	1,031,360	173,631
Guanaxuato	1,937,895	531,138
San Luis Potosi	1,491,058	24,465
Durango	536,272	386,081
Guadalaxara	405,357	103,615
Bolaños	336,355	27,614
Sombrerete	136,395	184,205
Zimapan	1,215	247,002
Pachuca	269,536	185,500
Rosario	477,134	191,368
Total in lbs. troy	7,572,762	2,159,454

In times of peace, amalgamation gains a gradual ascendancy over smelting, which is generally badly managed. As wood is becoming yearly more scarce on the ridge of the Cordilleras, which is the most populous part, the diminution of the produce of smelting is very advantageous to the manufactories which require a great consumption of combustibles. In time of war the want of mercury arrests the progress of amalgamation, and compels the miner to endeavour to improve the process of smelting. M. Velasquez, the director general of the mines, supposed even in 1797, before the dis-

covery of the rich mines of Catorce, where there is scarcely any smelting, that of all the ores of New Spain two-fifths were smelted, and the other three-fifths amalgamated.

The limits prescribed by us in the execution of this work, do not permit us to enter into any detail of the processes of amalgamation used in Mexico. It is sufficient to give a general idea of them, to examine the chemical phenomena which are exhibited in the greatest part of these processes, and to show the difficulties which in the New Continent oppose the introduction of the method invented in Germany in 1786, by Born, Ruprecht, and Gellert.

The ancients knew the property which mercury possesses of combining with gold; and they made use of amalgamation in gilding copper, and collecting the gold contained in their worn out dresses, by reducing them to ashes in clay vessels. It appears certain, that before the discovery of America the German miners used mercury, not only in washing auriferous earths, but also in extracting the gold disseminated in veins, both in its native state, and mixed with iron pyrites, and with the gray copper ore. But the amalgamation of silver ores, and the ingenious process now used in the New World, to which we owe the greater part of the valuable metals existing in Europe, or which have flowed from Europe to Asia, go no further back than the year 1557. It was invented in

Mexico by a miner of Pachuca of the name of Bartholome de Medina.

Cold amalgamation was found so profitable in Mexico, that in 1562, five years after the first discovery of the process of Medina, there were already 35 works at Zacatecas in which minerals were treated with mercury, notwithstanding Zacatecas is three times further from Pachuca than the old mines of Tasco, Zultipeque, and Tlapujahua.

The Mexican miners do not appear to follow any very fixed principle, in the selection of the ores submitted to smelting or amalgamation; for we see them smelt in one district of mines, the same mineral substances which in another they believe can only be managed with mercury. The ores which contain muriate of silver, for example, are sometimes smelted with carbonate of soda *(tequesquite)*, and sometimes destined to the processes of hot and cold amalgamation; and it is frequently only the abundance of mercury, and the facility in procuring it, which determine the miner in the choice of his method. In general they find it necessary to smelt the very rich *meagre ores*, those which contain from 6lbs. to $7\frac{1}{2}$lbs. troy of silver per cwt., argentiferous sulphuret of lead, and the ores mixed of blende and vitreous copper. On the other hand, they find it profitable to amalgamate the *pacos* or *colorados*, destitute of metallic lustre; native, vitreous, red, black, and horn-silver; *fah lore* rich in silver; and all the meagre ores

which are disseminated in very small particles in the gangue.

The ores destined for amalgamation must be triturated, or reduced to a very fine powder, to present the greatest possible contact with the mercury. This trituration under the *arastras* or mills, of which we have already spoken, is of all the metallurgical operations that which is executed in the greatest perfection in most of the Mexican works. In no part of Europe have I ever seen pulverized ores or powdered *schlich* so fine, and of so equal a grain, as in the great *haciendas de plata* of Guanaxuato, belonging to Count de la Valenciana, Colonel Rul, and Count Perez Galvez. When the ores are very pyritous, they are burnt *(quemar)* in the open air in heaps, on beds of wood, as at Sombrerete, or in *schlich* in reverberating furnaces *(comalillos)*. The latter I found at Tehuilotepec: they are 38 feet in length, without chimneys, but managed by two fires, the flames of which traverse the laboratory. This chemical preparation of the ores is however very rare in general; the size of the fragments of substances to be amalgamated, and the want of combustibles on the table-land of New Spain, render the process equally difficult and expensive.

The dry braying is done by *mazos*, eight of which work together, kept in motion by hydraulic wheels or by mules. The brayed ore (*granza*) passes through a hide pierced with holes; and it is re-

duced to a very fine powder under the *arastras* or *tahonas*, which are called *sencillas* or *de marco*, according as they are furnished with two or four blocks of porphyry or basalt (*piedras voladoras*), which revolve in a circle from 29 to 38 feet in circumference. From 12 to 15 of these *arastras*, or mills, are generally ranged in a row under one shed; and they are moved by water, or by mules which are relieved every eight hours. One of these machines brays in the space of 24 hours, from 660 to 880lbs. avoirdupois of ores. The moist *schlich* (*lama*) which leaves the *arastras*, is sometimes washed again in cisterns (*estanques de deslamar*), the construction of which, in the district of mines of Zacatecas, has been recently carried to perfection by M. Garcès. When the ores are very rich, as in the mine of Rayas at Guanaxuato, they are only reduced under the stones of the mills to the size of coarse sand (*xalsonte*), and they separate by washing the richest metallic grains (*polvillos*), which are destined for smelting. This very economical operation is called *apartar polvillos*.

I have been assured, that when they are about to amalgamate silver ores which are very poor in gold, they pour mercury into the vessel or trough, on the bottom of which the stones of the *arastras* turn: the auriferous amalgamation then goes on in proportion as the ore is reduced to powder, the rotatory motion of the *piedras voladeras* being favourable to the combination of the metals. I had

no opportunity of seeing this operation, which is not practised at Guanaxuato. In some great amalgamation works of New Spain, the *arastras* are still unknown; they are contented with the braying of the *mazos*; and the *schlich* which comes from under them is passed through sieves (*cedazos* and *tolvas*). This comminution is very imperfect; a powder of an unequal and coarse grain amalgamates very ill; and the health of the workmen suffers greatly, in a place where a cloud of metallic dust is perpetually flying about.

The moistened *schlich* is carried from the mills or *arastras*, into the court of amalgamation (*patio* or *galera*), which is generally paved with flags. The flour is ranged in piles (*montones*) which contain from 15 to 35 cwt. Forty or fifty of these *montones* form a *torta*, by which name they call a heap of moistened *schlich*, which they leave exposed to the open air, and which is frequently from 60 to 100 feet in breadth, by 20 to 24 inches in thickness. The materials used in amalgamation, which process is generally carried on in a paved court (*en patio*), are muriate of soda (*sal blanca*), sulphate of iron and copper (*magistral*), lime, and vegetable ashes.

It is by the contact of these different substances, namely, moistened ore in powder, mercury, muriate of soda, sulphates of iron and copper, and lime, that the amalgamation of silver, in the process of cold amalgamation (*de patio y por cruto*), takes place. They begin at first by mixing salt

with the metallic powder, and they stir (*repassar*) the paste (*torta*). According to the purity of the salt used, they give each cwt. of *schlich*, a quantity which varies from two and a half to twenty-four pounds. They leave the mineral mixed with salt (*metal ensalmorado*) for several days, in order that the latter may dissolve and be equally distributed. If the *azoguero* judges the metals to be *warm* (*calientes*), that is to say in a state of oxidation, and naturally charged either with sulphates of iron and copper which rapidly decompose in the air, or with muriate of silver, he adds lime to *cool* the mass; and this operation is called *curtir los metales con cal.* But they use *magistral*, if the *schlich* appears too cold (*frios*); for example, if it proceeds from ores which display great metallic lustre; if it contains sulphate of lead (*negrillos agalenados*), or pyrites difficult to decompose in the humid air; and this operation is called *curtir con magistral.* They attribute to the sulphate of iron and copper, the property of heating the mass; and they only consider it as well prepared, when, moistened and held in the hand, it causes a sensation of heat. In this case the sulphuric acid, which is concentrated in the acid sulphate, attracts the water, and, combining with it, gives out caloric.

We have described two processes of chemical preparation of minerals, *salting* (*el ensalmorar*), and *tanning* (*curtir*) with lime or magistral. After the interval of some days they begin to

incorporate (*incorporar*) the mercury with the metallic powder. The quantity of mercury is determined by the quantity of silver which they think will be drawn from the minerals; and they generally employ in the incorporation (*en el incorporo*) six times the quantity of mercury which the paste contains of silver. They allow from three to four pounds of mercury for half a pound of silver; and with the mercury, or shortly afterwards, they add to the mass, magistral, according to the nature, or (to use the barbarous language of the *azogueros*) according to the temperature of the minerals (*segun los grados de frialdad*). They allow from one to seven pounds of magistral to each pound of mercury; and if the mercury assumes a lead colour (*color aplomado,*) it is a mark that the paste is working, or that the chemical action has begun. To favour this action, and to augment the contact of the substances, they stir the mass (*se da repasso*) either by causing about twenty horses or mules to run round for several hours, or by setting workmen to tread the *schlich*, who for whole days go about barefooted in this metallic mud. Every day the *azoguero* examines the state of the powder; and he makes the trial (*la tentadura*) in a small wooden trough (*xicara*), that is to say, he washes a portion of *schlich* with water, and judges from the appearance of the mercury and the amalgam, if the mass is too cold or too warm. When the mercury takes an ash colour (*en lis ce-*

nicienta), when a very fine gray powder is separated from it which sticks to the fingers, they say the paste is too hot; and they cool it by the addition of lime. But if, on the other hand, the mercury preserves a metallic lustre, if it remains white, and covered with a reddish or gilt pellicle (*telilla roxiza o de tornasol morado* or *en lis dorada*); if it does not appear to act upon the mass, the amalgamation is then considered to be too cold, and they endeavour to heat it (*calentar*) by a mixture of magistral.

In this manner during the space of two, three, and even five months, the paste is balanced between the *magistral* and the lime, for the effects are very different according to the temperature of the atmosphere, the nature of the ores, and the motion given to the *schlich*. If they imagine that the action is too strong, and that the mass is working too much, they allow it to repose: or if they wish to accelerate the amalgamation, and increase the heat, they repeat the stirring more frequently, sometimes employing men, and sometimes mules. If the amalgamation is formed too quickly, and appears in the form of small globules, called *pasillas* or *copos*, they feed the *paste* (*si ceba la torta*) by again adding mercury with a little magistral, and sometimes with salt. When from the exterior characters the *azoguero* judges that the mercury has united with the whole silver contained in the ores, and that the paste has yielded (*ha rendido*),

the metallic muds are thrown into vats of wood or stone. Small mills provided with sails placed perpendicularly, turn round in these vats. These machines (*tinas de cal y canto*), which are particularly well executed at Guanaxuato, have a resemblance to those established at Freiberg for washing the remains of the amalgamation. The earthy and oxidated parts are carried away by the water, while the amalgam and the mercury remain in the bottom of the vat. As the force of the current carries away at the same time some globules of mercury, in the great works, Indian women are employed in gathering this metal from the water used in washing. They separate the amalgam collected at the bottom of the *tinas del lavadero* from the mercury, by pressing it through sacks; and they mould it into pyramids, which they cover with a reversed crucible in the shape of a bell. The silver is separated from the mercury by means of distillation. In the process which I have been describing, they lose in general from $1\frac{1}{2}$ to $1\frac{3}{4}$lb. of mercury for each pound of silver. In the process of amalgamation introduced into Saxony by MM. Gellert and Charpentier, the consumption of mercury is $\frac{3}{10}$ per pound of silver, or eight times less than the proportion used in Mexico.

We have described the cold amalgamation (*por crudo y de patio*), without roasting the ores, and by exposing them in a court to the open air. Medina was only acquainted with the use of salt, and

sulphates of iron and copper; but in 1586, fifteen years after his process was introduced into Peru, Carlos Corso de Leca, a Peruvian miner, discovered the *beneficio de hierro*. He advised the mixture of small plates of iron with the metallic powder, affirming that by this mixture more then nine-tenths of the mercury would be saved. This process, as we shall afterwards see, is founded on the decomposition of the muriate of silver by the iron, and on the attraction of this metal for the sulphur. It is now but very little followed by the Mexican *azogueros*. In 1590, Alonzo Barba proposed the hot amalgamation in copper vats. This process is called the *beneficio de cazo y cocimiento*, which was proposed by M. Born, 1786. The loss of mercury is much less by it than in the *beneficio por patio*, because the copper of the vessels serves to decompose the muriate of silver, while at the same time the heat favours the operation, either in rendering the action of the affinities more powerful, or in giving motion to the liquid mass which enters into ebullition. This hot amalgamation is used in several of the mines of Mexico, which abound in *horn-silver* and *colorados*. Juan de Ordoñez, whose work has been already quoted, even advised amalgamation by means of stoves. In 1676, Juan de Corrosegarra discovered a process which is very much in use at present, called the *beneficio de la pella de plata*; and in which silver already formed is added to the mercury of the amalgam. It is

said, that this amalgam (*pella*) favours the extraction of the silver, and that the loss of mercury is so much less, as the amalgam disseminates itself with greater difficulty into the mass. A fifth method is the *beneficio de la colpa*, in which, instead of an artificial *magistral*, which contains much more of the sulphate of copper than of the sulphate of iron, they use *colpa*, which is a natural mixture of acid sulphate of iron and iron oxidated to the *maximum*. This *beneficio de la colpa*, extolled by Don Lorenzo de la Torre, offers part of the advantages which we have just pointed out in speaking of the amalgamation by iron.

Since the practice of amalgamation of silver ores was introduced into Europe, and since the learned of every nation met at the metallurgic congress of Schemnitz*, the confused theory of Barba, and the Mexican *azogueros*, has been succeeded by sounder ideas, better adapted to the present state of chemistry. It is supposed that the practice of Freiberg, where a mass of roasted ores is amalgamated in a very few hours, will be gradually introduced into the amalgamation of Mexico, where the ores are generally not roasted, and where they remain exposed in the open air to the sun and the rain for several months.

The enormous waste of mercury which we observe in the American process of amalgamation

* Properly Szkleno or Glashutte, near Schemnitz.

proceeds from several causes which act simultaneously. If in the process *por patio* all the silver extracted were owing to a decomposition of muriate of silver by mercury, there would be lost a quantity of mercury which would be to that of the silver in the muriate, nearly as 4 : 7. 6; for this ratio is that of the respective oxidations of the two metals. Another and perhaps the most considerable part of the mercury is lost, because it remains disseminated in an immense mass of the moistened powder (*schlich*); and this division of the metal is so great, that the most careful washing is not sufficient to unite the particles concealed in the residue. A third cause of the loss of the mercury must be sought for in its contact with the salt water, in its exposure to the open air and the rays of the sun for the space of three, four and even five months. These masses of mercury and *schlich*, which contain a great number of heterogeneous metallic substances, moistened by saline solutions, are composed of an infinite number of small *galvanic piles*, of which the slow but prolonged action is favourable to the oxidation of the mercury, and the play of chemical affinities.

It results from these researches, that the use of fire will sensibly improve the process of amalgamation. If the minerals to be treated are only vitreous silver, iron filings alone would be perhaps sufficient to lay the silver bare, and separate it from the sulphur which retards its union with the mer-

cury. But as in all the other silver ores there are, besides sulphur, different metals combined with the silver, the simultaneous employment of muriate of soda, and sulphates of copper and iron, becomes necessary to favour the disengagement of the muriatic acid, which combines with the copper, iron, antimony, lead and silver. The muriates of iron, copper, zinc, and arsenic, and even that of lead, remain dissolved; and the muriate of silver, which is next to insoluble, is decomposed by contact with the mercury.

The amalgamation, such as we have described it, serves to extract all the silver from the ores which have been treated by mercury, provided the *azoguero* be experienced, and thoroughly know the aspect or external character of the mercury, by which to judge if the paste is in want of lime or sulphate of iron. At Guanaxuato, where this operation is best managed, ores are successfully amalgamated which contain only 15 ounces of silver per ton. M. Sonneschmidt found only $\frac{3}{4}$ of an ounce of silver in the residue of amalgamation proceeding from ores of which the ton contained from 700 to 900 ounces of silver. In the works of Regla, on the other hand, the *schlich* frequently undergoes washing before the mercury has extracted all the silver in the paste; and it is believed at Mexico, that the father of the present proprietor of the famous mine of Biscaina threw, with the refuse, an enormous mass of silver into the river.

After treating of the amalgamation in use in America, it remains for us to touch upon a very important problem, that of the quantity of mercury annually required by the mines of New Spain. Mexico and Peru depend very much upon the abundance and low price of the mercury for the quantity of silver which they produce. When the mercury fails them, which happens often in periods of maritime war, the mines are not so briskly worked; and the ores accumulate on their hands without their being able to extract the silver from them. Rich proprietors, who possess in their magazines ores to the amount of two or three millions of francs, are frequently in want of the necessary money to make head against the daily expenses of their mines. On the other hand, the more mercury is wanted in Spanish America, either on account of the flourishing state of the mines, or the process of amalgamation followed there, the more the price of this metal rises in Europe. The small number of countries which nature has supplied with it, Spain, the department of Mont-Tonnerre, Carniola, and Transylvania, gain by this rise; but the districts of silver mines in which the process of amalgamation is the more desirable, as they are in want of the necessary combustibles for smelting, feel very disadvantageously the necessity for great importations of mercury into America.

Mexico consumes annually upwards of 2,000,000 pounds troy of mercury. In 1803, a very useful

project was formed in Spain of supplying Mexico for several years, in order that in the unforeseen case of a war, the amalgamation might not be impeded by the want of mercury; but this project (*del requesto*) shared the fate of so many others which have never been executed. Before 1770, when the working of mines was far from being so considerable as at present, New Spain received no other mercury but that of Almaden and Huancavelica. The German mercury furnished by the Austrian Government, of which the greatest part is from Idria, was only introduced into Mexico after the falling in of the subterraneous works of Huancavelica, at a time when the mine of Almaden was inundated in the greatest part of its works, and yielded a very inconsiderable produce. But in 1800 and 1802, this last mine was again in such a flourishing state, that it could alone have furnished more than 20,000cwt. of mercury per annum, and there were sufficient grounds to conceive the hope of a termination of the necessity for recurring to German mercury, for the supply of Mexico and Peru. There have been years, when 10 or 12,000cwt. of this last mentioned mercury have been imported at Vera Cruz. Upon the whole, from 1762 to 1781, the amalgamation works of New Spain destroyed the enormous quantity of 25,124,200lbs. troy, of which the value in America amounted to more than 2,400,000*l.*

When the price of mercury has progressively lowered, the working of the mines has gone on increasing. In 1590, under the Viceroy Don Luis de Velasco II., a cwt. of mercury was sold in Mexico for 40*l.* 10*s.* But in the 18th century, the value of this metal had diminished to such a degree, that in 1750 the court distributed it to the miners at 17*l.* 15*s.* Between 1767 and 1776, its price was 13*l.* 9*s.* per cwt. In 1777, under the administration of the Minister Galvez, a royal decree fixed the price of the mercury of Almaden at 8*l.* 17*s.* 6*d.*, and that of Germany at 13*l.* 13*s.* At Guanaxuato, these two sorts of mercury are increased by the expensive carriage on the backs of mules, from 8*s.* 8*d.* to 10*s.* 10*d.* per cwt.

The impartial distribution of mercury *(el repartimiento del azogue)* is of the greatest consequence to the prosperity of the mines of New Spain. Unfortunately, however, the viceroys and those persons who were about them, under the old government, were jealous of the right of administering this branch of the royal revenue. They knew very well that to distribute mercury, and especially that of Almaden, which is one third cheaper than that of Idria, was to concede a favour; and in the colonies, as every where else, it is profitable to favour the richest and most powerful individuals. From this state of things, the poorest miners, those of Tasco, Temascaltepec, or Copala,

could not procure mercury, when the great works of Guanaxuato and Real del Monte had it in abundance.

The following table* proves the influence of the price of mercury on its consumption. The diminution of this price, and the freedom of trade with all the ports of Spain, have jointly contributed to the progress of mining.

Periods.	Price of a cwt. of mercury.	Total consumption of mercury.
	£. s. d.	
1762—1766	17 15 0	35750 cwt.
1767—1771	13 9 0	42000
1772—1777	13 9 0	53000
1778—1782	8 17 6	59000

It was known in Mexico in 1782, that China possesses mercury mines; and it was imagined that nearly 15,000 cwt. might be annually drawn from Canton. The Viceroy Galvez sent thither a cargo of otter skins by way of exchange for the mercury; but this project, wise in itself, was badly executed. The Chinese mercury obtained from Canton and Manilla was impure, and contained a great deal of lead; and its price amounted to 17*l.* 6*s.* 8*d.* the cwt. Even at this price, only a very small quantity could be procured. Since 1793, this

* Influxo del precio del azogue sobre su consumo, por Don Antonio del Campo Marin. (MS.)

important object has been totally lost sight of; yet it is deserving of the utmost attention, especially at a time when the Mexicans experience great difficulty in procuring mercury from the Continent of Europe.

From all the researches which I could make, the whole of Spanish America, namely, Mexico, Peru, Chili, and the kingdom of Buenos Ayres, (for elsewhere the process of amalgamation is unknown,) annually consume more than 25,000 cwt. of mercury, the price of which in the Colonies amounts to more than 250,000*l.* sterling. M. Heron de Villefosse, in an interesting table which contains the quantity of each metal extracted from the mines over the whole globe, estimates the mercury annually drawn from those of Europe at 36,000 cwt. From these data we find that mercury is, after cobalt, the rarest of all metals, and that it is even twice as rare as tin.

The following table indicates the quantity of mercury lost in the processes of amalgamation, used in different districts of mines, to extract the silver from the ore. A loss *(perdida y consumo)* of 100lbs. of mercury is computed

	lbs. troy of silver.
In the mines of Guanaxuato, for about -	65
In the mines of the intendancy of Guadalaxara - - - - - -	58

In the mines of Pachuca, Zacatecas, Sombrerete, Guadiana, Durango, Parral, Zichu, Tonala, Comanja, Zerralbo, Temextla, Alchichica, Tepeaca, Zimapan, Cairo and Tlapa - - - - - - -	52
In the mines of Chichiapa, Tetala, Tasco, Santa Theresa de Leiba y Banos, Ituquaro, Tehuistla, San Esteban de Albukquerque, and Chiconasi - - - - -	48
In the mines of Temascaltepec, Ayuteco, and Chautla de la Sal - - - -	44
In the mines of Zacualpa, San Luis Potosi, Guautla, Sultepec, and Tlapujahua -	42

The Government regulates the distribution *(repartimiento)* of silver, according to these data, and the quantity of silver annually extracted from the different districts of mines.

The amalgamation of a hundred weight of ores, which contain from three and a half to four ounces of silver, costs in Mexico, including the loss of mercury, from four to five shillings. M. Sonneschmidt calculates the loss of mercury at ten, twelve, or fourteen ounces for eight ounces of silver; and he reckons 8 ounces of mercury consumed *(azogue consumido)*, and from 3 to 6 ounces lost *(azogue perdido)*.

From December 1801 till August 1804, Spain received from its colonies 23,250,094*l.* in gold and silver, and 13,725,961*l.* in agricultural pro-

duce. From 1788 to 1795 the total importation was only at an average, from seven to ten millions sterling per annum.

The produce of the mines of Spanish America varies a seventh from year to year, or more than 310,000lbs. troy of silver. We have estimated this produce for the Spanish and Portuguese colonies at 17,291 kilogrammes of gold, or 75,217 Castilian marcs, and at 795,581 kilogrammes or 4,460 Castilian marcs of silver, which together are of the value of 9,400,000*l*. Europe, Siberia, and America furnish per annum 57,368lbs. in gold, and 2,175,000lbs. in silver, or to the value of 10,755,000*l*.

NOTE I.

The Baron de Humboldt proves to us in these remarks that he is well acquainted with practical mining, and that his information is likely to be most valuable on that account. I would particularly direct the attention of English Miners to what is said (page 189) respecting the great size of the shafts and levels, particularly of the latter, and to the influence justly drawn in the following page, that this has prevented the proprietors from making trials which are so indispensable for the preservation of a mine.

If these works have not been properly carried on, it may be so much the better for those who are about to commence a new system of operations. Every miner from Cornwall knows that the greater part of the profits on the Mines of that country have of late arisen from a judicious system of exploring ground which had formerly been neglected. It is hoped that experience so valuable for the enterprize in question, will be actively and successfully applied.

I have seen many Mines in England and Wales to which M. de Humboldt's remark might have been justly applied, and which were abandoned for want of the trials he recommends. The working of these having been resumed of late years and

conducted on a better system, they have become very profitable.

The untried ground on the veins between different mines on the same lode, or the high ground standing, should be accurately inspected. There is evidence enough in this chapter that much is to be done, and that a great probability exists of beneficial results.

I need hardly say any thing on the mode of drawing the water or the ores, the improvements with respect to which, have been considerable in England in the last twenty years. Every one who is sent to manage mines in Mexico, should of course understand these improvements well. J. T.

NOTE 2.

On the mode of dressing the ores we have no very precise information; the author praises the trituration or grinding to a fine powder: this is necessary where amalgamation is used, but would be less so for smelting. It appears, however, that their machines only grind from 660 to 880 lbs. in 24 hours. A good stamping mill with 3 heads would probably do 4 times as much; and as 24 heads would be worked by a small steam engine, such a machine would do the work of between 30 and 40 of their mills: consequently, ores that would not pay in the old method, would give large profits by the new. I have said elsewhere, that I conceive it to be a great object to dress the ores as clean as possible, and to reduce the bulk to the smallest possible quantity. This I think must be true, whether amalgamation be used, or smelting, with a scarcity of fuel.

It appears that the pyritous ore, or mundic containing silver, which is often very plentiful, is sometimes calcined in reverberatory furnaces or burning-houses. This operation appears to be ill performed, and must be attended to. I should think it an essential process for those ores which are very valuable.

In page 206, we are told that smelting is badly performed.

The improvement of this process, as well as of that of dressing, will of course demand great attention. Their importance may be estimated by their effect on the consumption of quicksilver, the cost of which, as stated in the latter part of the chapter, forms one of the most formidable deductions from the profits of the mines. J. T.

CHAPTER XI.

Intendancy of Guanaxuato.—Situation—extent—cultivation—population—towns—mining districts—geological constitution.

We shall now subjoin some more particular details concerning the mining districts, and the intendancies in which they are situate; taking them in the order of their comparative wealth and importance.

I. *Intendancy of Guanaxuato.*

Extent in North Latitude.	Extent in West Longitude.	Population in 1803.	Extent of Surface in square Leagues.	No. of Inhabitants to the square League.
From 20° 55′ to 21° 30′	From 102° 30′ to 103° 45′	517,300	8199	695

This province, wholly situated on the ridge of the Cordillera of Anahuac, is the most populous in New Spain. The population is also more equally distributed here than in any of the other provinces. Its length, from the lake of Chapala to the north-east of San Felipe, is 156 miles, and its breadth, from the Villa de Leon to Celaya, 93 miles. Its territorial extent is nearly the same as that of the

GEO. W. GLASS
MEXICO

kingdom of Murcia; and in relative population it exceeds the kingdom of the Asturias. Its relative population is even greater than that of the departments of the *Hautes-Alpes*, *Basses-Alpes*, *Pyrenées Orientales*, and the *Landes*. The most elevated point of this mountainous country seems to be the mountain de los Llanitos in the Sierra de Santa Rosa. I found its height above the level of the sea 9235 feet.

The cultivation of this fine province, part of the old kingdom of Mechoacan, is almost wholly to be ascribed to the Europeans, who arrived there in the 16th century, and introduced the first germ of civilization. It was in these northern regions, on the banks of the Rio de Lerma, formerly called Tololotlan, that the engagements took place between the tribes of hunters and shepherds, called in the historians by the vague denominations of Chichimecs, who belonged to the tribes of the Pames, Capuces, Samues, Mayolias, Guamanes, and Guachichiles Indians. In proportion as the country was abandoned by these wandering and warlike nations, the Spanish conquerors transplanted to it colonies of Mexican or Aztec Indians. For a long time agriculture made more considerable progress than mining. The mines, which were of small celebrity at the beginning of the conquest, were almost wholly abandoned during the seventeenth and eighteenth centuries; and it is not more than thirty or forty years since they

became richer than the mines of Pachuca, Zacatecas, and Bolaños. Their metallic produce, as we shall hereafter explain, is now greater than the produce of Potosi or any other mine in the two continents ever was.

There are in the intendancy of Guanaxuato 3 *ciudades* (viz. Guanaxuato, Celayo, and Salvatierra); 4 *villas* (viz. San Miguel el Grande, Leon, San Felipe and Salamanca); 37 villages or *pueblos*; 33 parishes *(paroquias)*; 448 farms or *haciendas*; 225 individuals of the secular clergy, 170 monks and 30 nuns; and in a population of more than 180,000 Indians, 52,000 subject to tribute.

The most remarkable towns of this intendancy are the following:

	Population.
Guanaxuato, or Santa Fe de Gonnajoato. The building of this city was begun by the Spaniards in 1554. It received the royal privilege of *villa* in 1619; and that of *ciudad* the 8th December 1741. Its present population is:	
Within the city *(en el casco de la ciudad)*	41,000
In the mines surrounding the city, of which the buildings are contiguous, at Marfil Santa Ana, Santa Rosa, Valenciana, Rayas, and Mellado . .	29,600
	70,600

Among whom there are 4500 Indians. Height of the city at the Plaza Mayor near 6836 feet. Height of Valenciana at the mouth of the new pit *(tiro nuevo)* 7586 feet. Height of Rayas at the mouth of the gallery 7075 feet.

Salamanca, a pretty little town, situated in a plain which rises insensibly by Temascatio, Burras and Cuevas, towards Guanaxuato. Height 5762 feet.

Celaya. Sumptuous edifices have recently been constructed at Celaya, Queretaro, and Guanaxuato. The church of the Carmelites at Celaya has a fine appearance. It is adorned with Corinthian and Ionic columns. Height 6018 feet.

Villa de Leon, in a plain eminently fertile in grain. From this town to San Juan del Rio are to be seen the finest fields of wheat, barley, and maize.

San Miguel el Grande, celebrated for the industry of its inhabitants, who manufacture cotton cloth.

The hot wells of San Jose de Comangillas are in this province. They issue from a basaltic opening. The temperature of the water, according to experiments made jointly by myself and Mr. Roxas, is 205°·3 Fahr. thermometer.

Disputaciones de Mineria, or Districts.

1. Guanaxuato.

Reales, or places surrounded with Mines :

Guanaxuato : Villalpando; Monte de San Nicolas; Santa Rosa; Santa Ana; San Antonio de las Minas; Comanja; Capulin; Comanjilla; Gigante; San Luis de la Paz; San Rafael de los Lobos; Durasno; San Juan de la Chica; Rincon de Centeno; San Pedro de los Pozos; Palmos de Vega; San Miguel el Grande; San Felipe.

The district of Guanaxuato is as remarkable for its natural wealth as for the gigantic labours of man in the bowels of the mountains.

In the centre of the intendancy of Guanaxuato on the ridge of the Cordillera of Anahuac, rises a group of porphyritic summits known by the name of the Sierra de Santa Rosa. This group of mountains, partly arid, and partly covered with strawberry trees and evergreen oaks, is surrounded with fertile and well cultivated fields. To the north of the *Sierra*, the *Llanos* of San Felipe extend as far as the eye can reach; and to the south, the plains of Irapuato and Salamanca exhibit the delightful spectacle of a rich and populous country. The *Cerro de los Llanitos*, and the *Puerto de Santa Rosa*, are the most elevated summits of this group

of mountains. Their absolute height is from 9000 to 9300; but as the neighbouring plains, which are part of the great central table-land of Mexico, are more than 6000 feet above the level of the sea, these porphyritic summits appear but as inconsiderable hills to the eye of a traveller accustomed to the striking appearance of the Cordilleras. The famous vein of Guanaxuato, which has alone, since the end of the sixteenth century, produced a mass of silver equal to nearly 58,000,000*l.*, crosses the southern slope of the Sierra Santa de Rosa.

In going from Salamanca to Burras and Temascatio, we perceive a chain of mountains which, bounding the plains, stretches from the south-east to the north-west. The crest of the vein follows this direction. At the foot of the Sierra, after passing the farm of Xalapita, we discover a narrow ravine, dangerous to pass at the period of the great swells, called the *Canada de Marfil*, which leads to the town of Guanaxuato. The population of that town, as we have already observed, is more than 70,000 souls. One is astonished to see in this wild spot, large and beautiful edifices in the midst of miserable Indian huts. The house of Colonel Don Diego Rul, who is one of the proprietors of the Valenciana mine, would be an ornament to the finest streets of Paris and Naples. It is fronted with columns of the Ionic order, and the architecture is simple, and remarkable for great purity of

style. The erection of this edifice, which is almost uninhabited, cost more than 33,000*l.*—a considerable sum in a country where the price of labour and materials is very moderate.

The name of Guanaxuato is scarcely known in Europe; yet the riches of the mines of this district are much greater than those of the metalliferous depositary of Potosi. The latter was discovered in 1545 by Diego Hualca an Indian, and has produced, (according to information never yet made public,) in the space of two hundred and thirty-three years, 57,068,488 lbs. troy of silver, worth 170,789,344*l.* sterling.

	Pounds Sterling.		lbs. Troy.
From 1556—1578....	10,619,112	or	3,548,328
1579—1736....	132,469,881	—	44,264,213
1737—1789....	27,700,351	—	9,255,947
	170,789,344		57,068,488

The produce of the vein of Guanaxuato is almost double that of the Cerro de Potosi. There is actually drawn from this vein (for it alone furnishes all the silver of the mines of the district of Guanaxuato), in average years, about 300,000 lbs. troy *of silver, and* 1000 lbs. troy *of gold.*

It is found from official papers, that the district of mines of Guanaxuato has produced in 38 years gold and silver to the value of 35,750,000*l.* ster-

ling, and that from 1786 to 1803, the annual average produce has been 342,231 lbs. troy of silver, equal to 1,059,655*l.* sterling. All the veins of Hungary and Transylvania together, yield only 55,686 lbs. troy of silver.

Taking four averages of years, of which three are of ten and one of eight years, we shall have the following results:

Periods.	Value of the total produce of gold and silver extracted from the mines of Guanaxuato.	Silver for an average year.	Value of gold and silver for an average year.
	Pounds Sterling.	lbs. Troy.	Pounds Sterling.
1766—1775	6,569,442	210,609	656,944
1776—1785	10,116,786	324,997	1,011,678
1786—1795	10,547,910	345,191	1,054,790
1796—1803	8,516,325	339,273	1,064,521

The rocks known in the district of Guanaxuato, are clay-slate and chlorite-slate *(killas)*, which are considered to be of primitive formation.

In sinking the great shaft at the Valenciana mine, they went through floors of syenite, hornblende-slate, and true serpentine.

There are resting on some parts of the clay-slate of this district, porphyry and old sandstone. The porphyry forms gigantic masses on the surface. The sandstone occurs at lower elevations, and is a breccia with an argillaceous cement.

This formation serves again as a basis to other secondary beds, such as limestone and gypsum.

Floors or courses of greenstone are also sometimes found in the primitive rocks.

Such is the geological constitution of the country at Guanaxuato. The vein *(veta madre)* traverses clay-slate as well as porphyry; and in both of these rocks it has proved very rich in ore. Its mean direction is h. $8\frac{1}{8}$ of the miner's compass*; and is nearly the same with that of the *veta grande* of Zacatecas, and of the veins of Tasco and Moran, which are all western veins *(spathgänge)*. The inclination of the vein of Guanaxuato is 45 or 48 degrees to the south-west. We have already stated, that it has been wrought for a length of more than 39,000 feet; and yet the enormous mass of silver which it has supplied for the last hundred years,—sufficient of itself to produce a change in the price of commodities in Europe,—has been extracted from that part of the vein alone contained between the shafts of Esperanza and Santa Anita, an extent of less than 8500 feet. In this part we find the mines of Valenciana, Tepayac, Cata, San Lorenzo, Animas, Mellado, Fraustros, Rayas, and Santa Anita, which at different periods have enjoyed great celebrity.

The *veta madre* of Guanaxuato exhibits the extraordinary example of a fissure formed accord-

* Or N. 52°. W.

ing to the direction and inclination of the strata of the rock. Towards the south-east from the ravine of Serena, or from the mines of Belgrado and San Bruno, which are very fully wrought, to beyond the mines of Marisanchez, it runs through porphyritic mountains; and towards the north-east, from the shafts of Guanaxuato to the Cerro de Buena Vista and the Cañada de la Virgen, it traverses clay-slate *(thon schiefer)*. Its magnitude varies like that of all the veins of Europe. When not ramified, it is generally from 40 to 50 feet in breadth; sometimes it is even contracted to the width of 20 inches; and it is for the most part found divided into three masses *(cuerpos)*, separated either by rock *(caballos)*, or by parts of the gangue almost destitute of metals. In the mine of Valenciana the *veta madre* has been found without ramification, and of the breadth of 22 feet, from the surface of the ground to the depth of 93 fathoms. At this point it divides into three branches, and its extent, reckoning from wall to wall of the entire mass, is from 160 to 200 feet. Of these three branches of vein, there is in general but one which is rich in metals; and sometimes when all the three join, as at Valenciana near the pit of San Antonio, at a depth of 164 fathoms the vein contains immense riches to a width of more than 80 feet. In the *pertinencia de Santa Leocadia*, four branches are observable. A branch, of which the inclination is 65°, separates from the

inferior branch *(cuerpo baxo)*, and cuts the rock of the wall.

The small ravines into which the valley of Marfil is divided, appear to have a decided influence on the richness of the *veta madre* of Guanaxuato, which has yielded the most metal where the direction of ravines and the slope of the mountains *(flaqueza del cerro)* have been parallel to the direction and inclination of the vein. When we stand on the elevation of Mellado, near the shaft which was sunk in 1558, we observe that the *veta madre* is in general most abundant in ores towards the north-west, towards the mines of Cata and Valenciana; and that to the south-east towards Rayas and Santa Anita, the produce has been at once richer, rarer, and more inconstant. Besides, in this celebrated vein there is a certain middle region which may be considered as a depositary of great riches; for above and below this region, the ores have yielded an inconsiderable share of silver. At Valenciana the rich ores have been in the greatest abundance, between 55 and 186 fathoms in depth below the mouth of the gallery. This abundance appeared at Rayas at the surface of the earth; but the level of Valenciana is pierced, according to my measurements, in a plain which is more than 511 feet above the level *(galerie d'ecoulement)* of Rayas; which might lead us to believe that the depositary of the great wealth of Guanaxuato is found in this part of the vein, between 6987 and 6199

feet of absolute height above the level of the ocean. The deepest works of the mine of Rayas *(los planes)* have never yet reached the lowest limit of this middle region; while the bottom *(das tiefste)* of the mine of Valenciana, the level of San Bernardo, has unfortunately passed this limit more than 230 feet. Hence the mine of Rayas continues to furnish extremely rich ores, while at Valenciana they have endeavoured for some years to supply by the extraction of a greater quantity of ores the deficiency in their intrinsic value.

The mineral substances which constitute the mass of the vein of Guanaxuato, are common quartz, amethyst, carbonate of lime, pearl spar, splintery hornstone, sulphuret of silver, dendritic native silver, prismatic black silver, deep red silver, native gold, argentiferous galena, brown blende, spar iron, and copper and iron pyrites. We observe besides, though much more rarely, crystallized feldspar (the rhomboidal quartz of the Mexican mineralogists), calcedony, small masses of spar-fluor, capillary quartz *(haarformiger quartz)*, gray copper ore *(fahlerz)*, and columnar carbonate of lead. The absence of the sulphate of barytes and muriate of silver distinguishes the formation of the vein of Guanaxuato from that of Sombrerete, Catorce, Fresnillo, and Zacatecas. Those mineralogists who are interested in the study of regular forms, find a great variety of crystals in the mines of Guanaxuato, and especially in the red and black

sulphuret of silver, and in the calcareous spar, and the brown spar.

The abundance of waters which filtrate through the crevices of the rock and the gangue, vary very much in the different points of the vein. The mines of Animas and Valenciana are entirely dry, though the works of the latter occupy a horizontal extent of 4920, and a perpendicular depth of 1640 feet. Between these two mines, in which the miner is incommoded by dust and heat*, lie the mines of Cata and Tepeyac, which remain inundated, because they do not possess sufficient mechanical force to draw off the water. At Rayas, it is drawn off in a very expensive manner by means of whims, worked by mules, placed under ground. One is astonished to see mines of such considerable wealth without any adit level, while the neighbouring ravines of Cata and Marfil, and the plains of Tenascatio, which are lower than the *bottom* of Valenciana, appear to invite the miners to undertake works which would both serve to draw off the water, and to transport the ores to the place where they are smelted and amalgamated.

The *Valenciana* is almost the sole example of a mine, which for forty years has never yielded less to its proprietors than from 80,000*l.* to 124,000*l.* per annum. It appears that the part of the vein extending from Tepeyac to the north-west, had

* From 71° to 80° Fahr.; the temperature of the exterior air being 62° Fahr.

not been much wrought towards the end of the 16th century. From that period the whole tract remained forsaken till 1760, when a Spaniard who went over very young to America, began to work this vein in one of the points which had till that time been believed destitute of metals *(emborascado)*. M. Obregon (the name of this Spaniard) was without fortune; but as he had the reputation of being a worthy man, he found friends who from time to time advanced him small sums to carry on his operations. In 1766, the works were already 44 fathoms in depth, and yet the expenses greatly surpassed the value of the metallic produce. With a passion for mining equal to what some men display for gaming, M. Obregon preferred submitting to every sort of privation, to the abandoning his undertaking. In the year 1767 he entered into partnership with a petty merchant of Rayas, of the name of Otero. Could he then hope that in the space of a few years he and his friend would become the richest individuals in Mexico, perhaps in the whole world? In 1768 they began to extract a very considerable quantity of silver minerals from the mine of Valenciana. In proportion as the shafts grew deeper, they approached that region which we have already described as the depository of the great metallic wealth of Guanaxuato. In 1771 they drew from the *pertinencia de Dolores* enormous masses of sulphuret of silver, mixed with native and red silver. From that period till 1804, when I quitted

New Spain, the mine of Valenciana has continually yielded an annual produce of more than 583,380*l.* There have been years so productive, that the net profit of the two proprietors of the mine has amounted to about 250,000*l.* sterling.

M. Obregon, better known by the name of Count de la Valenciana, preserved in the midst of immense wealth the same simplicity of manners, and the same frankness of character, for which he was distinguished previous to his success. When he began to work the vein of Guanaxuato, above the ravine of San Xavier, goats were feeding on the very hill which ten years afterwards was covered with a town of seven or eight thousand inhabitants. Since the death of the old Count, and his friend Don Pedro Luciano Otero, the property of the mine has been divided among several families*. I knew at Guanaxuato two younger sons of M. Otero, each of whom possessed, in ready money, a capital of 271,835*l.* sterling, without including the actual revenue from the mine, which amounted to more than 16,600*l.* sterling.

The constancy and equality of the produce of the mine of Valenciana, is so much the more surprising, as the abundance of the rich mines has considerably diminished, and the expenses of the

* The property of Valenciana is divided into twenty-eight shares, called *barres*, of which ten belong to the descendants of the Count de la Valenciana, twelve to the family of Otero, and two to that of Santana.

works have increased in an alarming proportion, when they have reached a perpendicular depth of 273 fathoms. The piercing and walling of the three old whim shafts cost the Count de Valenciana nearly 260,000*l.* sterling, viz.

	£.
The square shaft of San Antonio or *tiro viejo*, 128 fathoms in perpendicular depth, and four whims - -	86,000
The square shaft of Santo Christo de Burgos, 82 fathoms in depth, and two whims - - - -	22,000
The hexagonal shaft of Nuestra Señora de Guadalupe (*tiro nuevo*) 186 fathoms in perpendicular depth, and six whims	152,000
Expense of the three shafts	260,000

Within these twelve years they have begun to dig in the solid rock, in the roof of the vein, a new whim shaft (*tiro general*), which will have the enormous perpendicular depth of 281 fathoms, terminating at the actual bottom of the mine, or at the *planes of San Bernardo*. This shaft, which will be in the centre of the works, will considerably diminish the number of the 980 labourers (*tenateros*) employed as beasts of burden to carry the minerals to the upper places where ore is deposited. The whim shaft, which will cost more than 218,767*l.* sterling, is octagonal, and contains 87 feet of cir-

cumference. Its walling is most beautiful. It is believed that they will reach the vein in 1815, although in the month of September 1803 the depth did not exceed 100 fathoms. The piercing of this shaft is one of the greatest and boldest undertakings to be found in the history of mines. It may be questioned, however, whether for the sake of diminishing the expenses of carriage and draught, it was expedient to recur to a remedy which is at once slow, expensive, and uncertain.

The expenses of working the mine of Valenciana have been on an average annually:

	Pounds sterling.
From 1787 to 1791 - - -	89,694
From 1794 to 1802 - - -	194,708

Although the expenses are doubled, the profits of the share-holders have remained nearly the same.

The following Table contains an exact state of the mine for the last nine years.

	PERIODS.									Total of the 9 years.
	1794.	1795.	1796.	1797.	1798.	1799.	1800.	1801.	1802.	
Produce of the sale of the minerals of Valencia-na (pounds sterling)	277,775	367,605	285,008	461,162	373,628	343,286	320,868	302,106	266,420	2,997,666
Expenses of working (pounds st.)	173,188	176,760	180,341	190,404	192,992	198,344	211,751	214,929	204,600	1,743,314
Net profit divided a-mong the shareholders (pounds sterling)	104,587	190,845	104,667	270,758	180,636	144,942	109,117	87,177	61,820	1,254,352

The result of this table is, that the net profit of the shareholders has been latterly at an average of 139,372*l.* In 1802 circumstances were extremely unfavourable. The greater part of the ores were very poor, and their extraction attended with great expense; and besides this, the produce was sold at very low prices, because the want of mercury impeded the amalgamation, and all the mines were incumbered with ores. The year 1803 promised greater advantages to the proprietors, and they reckoned on a net profit of more than 109,383*l.* I saw them sell weekly at Valenciana, silver ores to the amount of more than 5,850*l.*, the expenses of which amounted to 3,683*l.* At Rayas the profit of the proprietor was greater, though the produce was less; for this mine furnished more than 3,250*l.* worth of ores weekly, while the expense of working only amounted to 866*l.* This was the effect of the richness of the ores, their concentration in the vein, the inconsiderable depth of the mine, and consequently a less expensive draught.

To form an idea of the enormous advances required in working the mine of Valenciana, it is sufficient here to mention, that in its present state there must be laid out annually,

£.	
136,000	in wages of miners, triers, masons, and other workmen employed in the mine.
44,000	in powder, tallow, wood, leather, steel, and other materials necessary in mining.
Total expense £180,000	

The consumption of powder alone has amounted to 16,668*l.*, and that of steel to 6,250*l.*: the number of workmen who labour in the interior of the mine of Valenciana amounts to 1,800. Adding 1,300 individuals (men, women, and children) who labour at the whims, in the carriage of ores to the places where they are tried, we shall find 3,100 individuals are employed in the different operations of the mine. The direction of the mine is entrusted to an administrator with a salary of 2,500*l.*, through whose hands upwards of 240,000*l.* annually pass. This administrator, who is under the controul of no one, has under his orders an overseer (*obersteiger*, *minero*), the under overseers (*untersteiger*, *sottomineros*), and nine master miners (*mandones*). These head people daily visit the subterraneous operations, carried by men who have a sort of saddle fastened on their backs, and who go by the name of little horses (*cavallitos*).

We shall conclude this account of the mine of Valenciana, with a comparative Table of the state of this Mexican work, and of that of the celebrated mine of Himmelsfürst in the district of Freiberg. I flatter myself that this Table will fix the attention of those who consider the study of the management of mines as an important object in political economy.

Comparative Table of the Mines of America and Europe.

Average year at the end of the eighteenth century.	America. Mine of Valenciana, the richest of the Mexican mines. At the surface, 9280 feet above the level of the sea.	Europe. Mine of Himmelsfürst, the richest of the Saxon mines. At the surface, 1638 feet above the level of the sea.
Metallic produce	221,538lbs. troy of silver	6,154lbs. troy of silver.
Total expenses of the mine	250,000*l.* sterling	9,600*l.* sterling.
Net profit of the share-holders	120,000*l.* sterling	3,600*l.* sterling.
The ton of ores contains in silver	80 ounces	From 120 to 140 ounces silver.
Number of workmen	3,100 Indians and Mestizoes, 1800 of whom are in the interior of the mine	700 miners, of whom 550 are in the interior of the mine.
Wages of the miners	From 3*s.* 6*d.* to 5*s.*	1*s.* 6*d.*
Expense of powder	16,000*l.* sterling (nearly 1,600 cwt.)	1,080*l.* sterling (nearly 270 cwt.)
Quantity of ores smelted and amalgamated	36,000 tons	700 tons.
Veins	A vein frequently divides into thin branches of from 150 to 200 feet of extent (in clay slate)	Five principal veins, from 60 to 90 feet extent (in *gneiss*).
Water	No water	Eight cubic feet per minute. Two hydraulic wheels.
Depth of the mine	278 fathoms	178 fathoms.

They reckoned in 1803, in the whole district of mines of Guanaxuato, 5000 miners and workmen employed in picking the ores, in smelting and amalgamating; 1896 *arastres*, or machines for reducing the ores into powder; and 14,618 mules destined to move the whims, and to tread for amalgamation the pulverized ores mixed with mercury. The *arastres* of the town of Guanaxuato bray, when there is an abundance of mercury, 568 tons of ores per day. If we recollect that the produce in silver is annually from 300,000 to 400,000 lbs. troy, we shall find by this datum, that the mean contents of the ores are extremely small.

CHAPTER XII.

Intendancy of Zacatecas—extent—towns—mines—geological structure.

Extent in north latitude.	Extent in west longitude.	Population in 1803.	Extent of surface in square miles.	No. of inhabitants to the square mile.
From 22° 20′ to 24° 33′	From 103° 12′ to 105° 9′	153,300	21,195	7⅓

This singularly ill-peopled province is a mountainous and arid tract, exposed to a continual inclemency of climate. It is bounded on the north by the intendancy of Durango, on the east by the intendancy of San Luis Potosi, on the south by the province of Guanaxuato, and on the west by that of Guadalaxara. Its greatest length is 255 miles, and its greatest breadth, from Sombrerete to the Real de Ramos, 153 miles.

The intendancy of Zacatecas is nearly of the same extent with Switzerland, which it resembles in many geological points of view. The relative population is hardly equal to that of Sweden.

The table-land which forms the centre of the intendancy of Zacatecas, and which rises to more than 6561 feet in height, is formed of syenites, a rock on which repose, according to the excellent observations of M. Valencia, strata of primitive schistus and schistous chlorites (*chlorith-schiefer*). The schistus forms the base of the mountains of *grauwacke* and trappish porphyry. North of the town of Zacatecas are nine small lakes, abounding in muriate, and especially carbonate, of soda. This carbonate, which, from the old Mexican word *tequixquilit*, goes by the name of tequesquite, is of great use in the dissolving of the muriates and of the sulphurets of silver. M. Garces, an advocate of Zacatecas, has recently fixed the attention of his countrymen on the tequesquite, which is also to be found at Zacualco, between Valladolid and Guadalaxara, in the valley of San Francisco, near San Luis Potosi, at Acusquilco, near the mines of Bolaños, at Chorro near Durango, and in five lakes round the town of Chihuahua. The central table-land of Asia is not more rich in soda than Mexico.

The most remarkable places of this province are:

Zacatecas, at present, after Guanaxuato, the most celebrated mining place of New Spain. Its population is at least 33,000.

Fresnillo, on the road from Zacatecas to Durango.

Sombrerete, the head town, and residence of a *Diputacion de Mineria*.

Besides the three places above named, the intendancy of Zacatecas contains also interesting metalliferous veins near the Sierra de Pinos, Chalchiguitec, San Miguel del Mezquitas, and Mazapil. It was this province, also, which in the mine of the *Veta Negra de Sombrerete* exhibited an example of the greatest wealth of any vein yet discovered in the two hemispheres.

Diputaciones de Mineria, or Districts.

2. Zacatecas.
3. Sombrerete.
4. Fresnillo.
5. Sierra de Pinos.

Reales, or places surrounded by mines:

Zacatecas; Guadalupe de Veta Grande; San Juan Baptista de Panuco; La Blanca; Sombrerete; Madroño; San Pantaleon de la Noria; Fresnillo; San Demetrio de los Plateros; Cerro de Santiago; Sierra de Pinos; la Sauceda Cerro de Santiago; Mazapil.

The celebrated mines of Zacatecas, called by Robertson Sacotecas, are, as we have already observed, older than the mines of Guanaxuato. They began to be worked immediately after the veins of Tasco, Zultepeque, Tlapujahua, and Pachuca. They are situated on the central table-land of the Cordilleras, which descends rapidly towards New Biscay, and towards the basin of the Rio del Norte.

The climate of Zacatecas, as well as that of Catorce, is much colder than the climate of Guanaxuato and Mexico. Barometrical measurements will one day determine whether this difference is owing to a more northern position, or to the elevation of the mountains.

The nature of the latter has been examined by two very intelligent mineralogists, MM. Sonnenschmidt and Valencia, the one a Saxon and the other a Mexican. From the whole of their observations it appears, that the district of mines of Zacatecas bears great resemblance in its geological constitution to that of Guanaxuato. The oldest rocks which appear at the surface are syenitic; they are overlaid by clay-slate, which from the beds of Lydian stone, *grauwacke* and greenstone which it contains, has a resemblance to transition clay-slate. The most part of the veins of Zacatecas are found in this clay-slate. The *veta grande*, or principal vein, has the same direction as the *veta madre* of Guanaxuato; the others are generally in a direction from east to west. A porphyry destitute of metals, and forming those naked and perpendicular rocks which the natives call *buffas*, covers in many places the clay-slate especially on the side of the *Villa de Xeres*, where a mountain rises in the midst of these porphyritic formations, in the form of a bell, the basaltic cone of the *Campana de Xeres*.

The savage aspect of the metalliferous mountains

of Zacatecas, forms a singular contrast to the great wealth of the veins which they contain. This wealth is displayed—and the fact is very remarkable—not in the ravines, and where the veins run along the gentle slope of the mountains, but most frequently on the most elevated summits, on points where the surface appears to have been violently torn in the ancient revolutions of the globe. The mines of Zacatecas produce yearly, on an average, from 2500 to 3000 bars of silver, at 82½ ounces each*.

The mass of the veins of this district contains a great variety of minerals, viz: quartz, splintery hornstone, calcareous spar, a little sulphate of barytes and brown spar; prismatic black silver, called in the country *azul acerado;* sulphuret of silver, *(azul plomilloso)* mixed with native silver; black silver, (the *silber-schwärtze* of the Germans, *polvorilla* of the Mexicans); pearl gray, blue, violet, and leek green muriate of silver (*plata parda azul y verde*) at very inconsiderable depths; a little red silver (*petlangue* or *rosicler*); and native gold, particularly to the south-west of the town of Zacatecas; argentiferous sulphuret of lead (*soroche plomoso reluciente y tescatete*); carbonate of lead; black, brown, and yellow sulphuret of zinc, (*estoraque* and *ojo de vivora*); copper and iron pyrites (*bronze nochistle* or *dorado*, and *bronze chino*); magnetic oxydulated iron; blue and green carbonate of copper, and sulphuret of antimony. The

*From 219,866 to 263,839lbs. troy.

most abundant metals of the celebrated vein called the *veta grande*, are prismatic black silver (*sprödglaserz*), sulphuret of silver, or vitreous silver, mixed with native and black silver.

The intendancy of Zacatecas contains the mines of *Fresnillo* and those of *Sombrerete*. The former are very feebly wrought, and are situated in an insulated group of mountains which rise above the plains of the central table-land. These plains are covered with porphyritic formations; but the metalliferous group itself is composed of *grauwacke*. According to the observation of M. Sonneschmidt, the rock is traversed there by an innumerable quantity of veins, rich in gray and green hornsilver.

The mines of Sombrerete have become celebrated from the immense riches of the vein of the *veta negra*, which in the space of a few months left to the family of Fagoaga (Marques del Apartado) a net profit of more than 834,000*l*. The greater part of these veins are found in a compact limestone, which, like that of Sauceda, contains flint-slate and lydian stone. The deep red silver is particularly abundant in this district of mines. It has been seen to form the whole mass of veins more than three feet in width. Near Sombrerete the mountains of secondary calcareous formation rise much above the porphyritic mountains. The Cerro di Papareton appears to be more than 11,000 feet above the level of the sea.

CHAPTER XIII.

Intendancy of San Luis Potosi—extent—climate—territorial division—towns—mines—wealth of the mine of Catorce.

Extent in north latitude.	Extent in west longitude.	Population in 1803.	Extent of surface in square miles.	No. of Inhabitants to the square mile.
From 22° 1′ to 27° 11′	From 100° 35′ to 103° 20′	334,900	250,389	1⅓

This intendancy comprehends the whole of the north-east part of the kingdom of New Spain. As it borders either on desert countries, or countries inhabited by wandering and independent Indians, we may say that its northern limits are hardly determined.

Of the whole intendancy of San Luis Potosi, only that part which adjoins the province of Zacatecas, in which are the rich mines of Charcas, Guadalcazar, and Catorce, is a cold and mountainous country. The bishopric of Monterey, which bears the pompous title of New Kingdom of Leon, Cohahuila, Santander, and Texas, are very low regions; and

there is very little undulation of surface in them. They possess an unequal climate, extremely hot in summer, and equally cold in winter when the north winds drive before them columns of cold air from Canada towards the torrid zone.

The intendancy of San Luis Potosi comprehends parts of a very heterogeneous nature, the different denominations of which have given great room for geographical errors. It is composed of provinces, of which some belong to the *Provincias internas*, and others to the kingdom of New Spain Proper. Of the former there are two immediately depending on the commandant of the *Provincias internas;* the two others are considered as *Provincias internas del Vireynato*. These complicated and unnatural divisions are explained in the following table:

The intendant of San Luis Potosi governs,

A. In Mexico Proper:

The *Province of San Luis*, which extends from the Rio de Panuco to the Rio de Santander, and which comprehends the important mines of Charcas, Potosi, Ramos, and Catorce.

B. In the *Provincias internas del Vireynato:*

1. The New Kingdom of Leon.
2. The colony of New Santander.

C. In the *Provincias internas de la Commandancia general Oriental:*

1. The province of Cohahuila.
2. The province of Texas.

It follows, from what we have already said on the latest changes which have taken place in the organization of the *Commandancia general* of Chihuahua, that the intendancy of San Luis now includes, besides the province of Potosi, all which goes under the denomination of *Provincias internas Orientales*. A single intendant is consequently at the head of an administration which includes a greater surface than all European Spain. But this immense country, gifted by nature with the most precious productions, and situated under a serene sky in the temperate zone, towards the borders of the tropic, is, for the greatest part, a wild desert, still more thinly peopled than the governments of Asiatic Russia. Its position on the eastern limits of New Spain, the proximity of the United States, the frequency of communication with the colonists of Louisiana, and a great number of circumstances which I shall not endeavour here to develope, will probably soon favour the progress of civilization and prosperity in these vast and fertile regions.

The intendancy of San Luis comprehends more than 690 miles of coast, an extent equal to that from Genoa to Reggio in Calabria. But all this coast is without commerce and without activity, with the exception of a few small vessels, which come from the West Indies to lay in provisions either at the Bar of Tampico, near Panuco, or at the anchorage of New Santander.

The most remarkable places of the intendancy of San Luis are:

San Luis Potosi, the residence of the intendant, situated on the eastern declivity of the table-land of Anahuac, to the west of the sources of the Rio de Panuca. The habitual population of this town is 12,000.

Nuevo Santander, capital of the province of the same name, does not admit the entry of vessels drawing more than from eight to ten *palmas** of water. The village of *Sotto la Marina*, to the east of Santander, might become of great consequence to the trade of this coast, if the port could be improved. At present the province of Santander is so desert, that fertile districts of 90 or 100 square miles were sold there in 1802 for eight or ten shillings.

Charcas, or *Santa Maria de las Charcas*, a very considerable small town, the seat of a *diputacion de Minas*.

Catorce, or *la Purissima Concepcion de Alamos de Catorce*, one of the richest mines of New Spain. The *Real* de Catorce, however, has only been in existence since 1773, when Don Sebastian Coronado and Don Bernabe Antonio de Zepeda discovered these celebrated veins, which yield annually the value of more than from 700,000*l.* to 800,000*l.* sterling.

* From $5\frac{1}{2}$ to 6.878 feet.

Monterey, the seat of a bishop, in the small kingdom of Leon.

Linares, in the same kingdom, between the Rio Tigre and the great Rio Bravo del Norte.

Monclova, a military post (*presidio*), capital of the province of Cohahuila, and residence of a governor.

San Antonio de Begar, capital of the province of Texas, between the Rio de los Nogales and the Rio de San Antonio.

Diputaciones de Mineria, or Districts.

6. Catorce.
7. San Luis Potosi.
8. Charcas.
9. Ojocaliente.
10. San Nicolas de Croix.

Reales, or places surrounded by mines :—

La Purissima Concepcion de Alamos de Catorce Matehualu; Cerro del Potosi; San Martin Bernalejo; Sierra Negra; Tule; San Martin; Santa Maria de las Charcas; Ramos; Ojocaliente; Cerro de San Pedro; Matanzillas; San Carlos de Vallecilio; San Antoniode la Yguana; Santiago de las Sabinas; Monterey; Jesus de Rio Blanco; Las Salinas; Bocca de Leones; San Nicolas de Croix; Borbon; San Joseph Tamaulipan; Nuestra Señora de Guadalupe de Sihue; La Purissima Concepcion de Re villagegido; El Venado; L. Tapona; Guadalcazar.

The mineral repository of Catorce holds at present the third rank among the mines of New Spain, classing them according to the quantity of silver which they produce. It was only discovered in the year 1778. This discovery, and that of the veins of Gualgayoc, in Peru, vulgarly called the Veins of Chota, are the most interesting in the history of the mines of Spanish America for the last two centuries. The small town of Catorce, the true name of which is *la Purissima Concepcion de Alamos de Catorce*, is situated on the calcareous table-land, which declines towards the *nuevo reyno de Leon*, and towards the province of New Santander. From the bosom of these mountains of secondary compact limestone, masses of basalt and porous amygdaloid rise up as in the Vicentin, which resemble volcanic productions, and contain olivine, zeolite, and obsidian. A great number of veins of small extent, and very variable in their breadth and direction, traverse the limestone, which itself covers a transition clay-slate; and the latter perhaps is superimposed on the syenitic rock of the *Buffa del Fraile*. The greatest number of these veins are western (*spathgänge*); and their inclination is from 25° to 30° towards the north-east. The minerals which form the lode are generally found in a state of decomposition. They are wrought with the mattock, the pickaxe, and with the gad (*pointrole*). The consumption of powder is much less than at Guanaxuato and at

Zacatecas. These mines possess also the great advantage of being almost entirely dry, so that they have no need of costly machines to draw off the water.

In 1773, Sebastian Caronado and Antonio Llanas, two very poor individuals, discovered veins in a situation now called *Cerro de Catorce Viejo*, on the western slope of the *Pichaco de la Variga de Plata*. They began to work these veins, which were poor and inconstant in their produce. In 1778, Don Barnabé Antonio de Zepeda, a miner of the *Ojo del Agua de Matchuala*, investigated during three months this group of arid and calcareous mountains. After attentively examining the ravines, he was fortunate enough to find the crest or surface of the *veta grande*, on which he immediately dug the pit of *Guadalupe*. He drew from it an immense quantity of muriate of silver, and *colorados* mixed with native gold; and gained in a short time more than 108,383*l*. From that period, the mines of Catorce were wrought with the greatest activity. That of *Padre Flores* alone produced in the first year upwards of 350,000*l*.; but the vein only displayed great riches from 160 to 330 feet of perpendicular depth. The famous mine of *Purissima*, belonging to Colonel Obregon, has scarcely ever ceased since 1788, to yield annually a net profit of 43,752*l*.; and its produce in 1796 amounted to 260,000*l*., while the expenses of working did not amount to more than 17,300*l*. The

vein of *Purissima*, which is not the same with that of *Padre Flores*, sometimes reaches the extraordinary extent of 130 feet; and it was worked in 1802 to the depth of 226 fathoms. Since 1798, the value of the minerals of Catorce has singularly diminished: the native silver is now rarely to be seen; and the *metales colorados*, which are an intimate mixture of muriate of silver, earthy carbonate of lead, and red ochre, begin to give place to pyritous and coppery minerals. The actual produce of these mines is nearly 262,526 lbs. of silver annually.

CHAPTER XIV.

Intendancy of Mexico—extent—climate—physical aspect—roads—principal towns—mines—Real del Monte, Moran Biscaina, Tasco—state of mining operations—geological structure.

Extent in north latitude.	Extent in west longitude.	Population in 1803.	Extent of surface in square miles.	No. of inhabitants to the square mile.
From 16° 34′ to 21° 57′	From 100° 12′ to 103° 25′	1,511,800	53,343	28⅓

THE whole of this intendancy is situated under the torrid zone. It extends from the 16° 34′ to the 21° 57′ of north latitude. It is bounded on the north by the intendancy of San Luis Potosi, on the west by the intendancies of Guanaxuato and Valladolid, and on the east by those of Vera Cruz and La Puebla. It is washed towards the south by the South Sea, or Great Ocean, for a length of coast of 246 miles, from Acapulco to Zacatula.

Its greatest length from Zacatula to the mines

of the Doctor is 408 miles; and its greatest breadth from Zacatula to the mountains situated to the east of Chilpansingo is 276 miles. In its northern part, towards the celebrated mines of Zimapan and the Doctor, it is separated by a narrow stripe from the Gulf of Mexico. Near Mextitlan, this stripe is only 27 miles in breadth.

More than two thirds of the intendancy of Mexico are mountainous, and contain immense plains, elevated from 6561 to 7545 feet above the level of the ocean. From Chalco to Queretaro are almost uninterrupted plains of 450 miles in length, and 80 or 90 in breadth. In the neighbourhood of the western coast the climate is burning and very unhealthy. One summit only, the Nevado de Toluca, situated in a fertile plain, of 8857 feet in height, enters the region of perpetual snow. The elevation of the Pico del Fraile, or the highest summit of the Nevado de Toluca, is 15,156 feet. No mountain in this intendancy equals the height of Mont Blanc.

The valley of Mexico, or Tenochtitlan, is situated in the centre of the Cordillera of Anahuac, on the ridge of the porphyritical and basaltic amygdaloid mountains, which run from the S.S.E. to the N.N.W. This valley is of an oval form; it contains 55 miles in length, and 37 in breadth. The territorial extent of the valley is 2,200 square miles, of which only 198 square miles are occupied by

the lakes, which is less than a tenth of the whole surface.

The circumference of the valley, reckoning from the crest of the mountains which surround it like a circular wall, is 201 miles. This crest is most elevated on the south, particularly on the south-east, where the great volcanos of La Puebla, the Popocatepetl and Iztaccihuatl, bound the valley.

Six great roads cross the Cordillera which incloses the valley, of which the medium height is 9842 feet above the level of the ocean: 1. the road from Acapulco to Guchilaque and Cuervaracca, by the high summit called la Cruz del Marques; 2. the road of Toluca by Tianguillo and Lerma, a magnificent causeway, which I could not sufficiently admire, constructed with great art, partly over arches; 3. the road of Queretaro, Guanaxuato and Durango *el camino de tierra adentro,* which passes by Guautitlan, Huehuetoca, and the Puerto de Reyes, near Bata, through hills scarcely 262 feet above the pavement of the great square (*place*) of Mexico; 4. the road of Pachuco, which leads to the celebrated mines of Real del Monte, by the Cerro Ventoso, covered with oak, cyprus, and rose trees, almost continually in flower; 5. the old road of La Puebla, by S. Bonaventura and the Llanos de Apan; and, 6. the new road of La Puebla by Rio Frio and Tesmelucos, south-east from the Cerro del Telapon.

The following are the remarkable towns (*ciudades y villas*) of the intendancy of Mexico.

	Population.
Mexico, capital of the kingdom of New Spain, height 7470 feet	137,000
Tezcuco, which formerly possessed very considerable cotton manufactories. They have suffered much, however, in a competition with those of Queretaro	5,000

Cuyoacan, containing a convent of nuns, founded by Hernan Cortez, in which, according to his testament, the great captain wished to be interred, "in whatever part of the world he should end his days." This desire was never fulfilled.

Tacubaya, west from this capital, containing the archbishop's palace and a beautiful plantation of European olive-trees.

Tacuba, the ancient Tlacopan, capital of a small kingdom of the Tepanecs.

Cuernavacca, the ancient Quauhnahuac, on the southern declivity of the Cordillera of Guchilaque, in a temperate and delicious climate, finely adapted for the cultivation of the fruit-trees of Europe. Height 5429 feet.

Chilpansingo (Chilpantzinco), surrounded with fertile fields of wheat. Elevation 3542 feet.

Tasco (Tlachco), containing a beau-

tiful parish church, constructed and endowed towards the middle of the 18th century by Joseph de Laborde, a Frenchman, who gained immense wealth in a short time by the Mexican mines. The building of this church alone cost this individual more than 83,000*l.* Towards the end of his career, being reduced to great poverty, he obtained from the archbishop of Mexico permission to sell for his benefit, to the metropolitan church of the capital, the magnificent *custodia* set with diamonds, which, in better times, he had devoutly offered to the tabernacle of the parish church of Tasco. Elevation of the city, 2567 feet.

Acapulco (Acapolco), at the back of a chain of granitical mountains, which, from the reverberation of the radiating caloric, increase the suffocating heat of the climate. The famous cut in the mountain (*abra de San Nicolas*), near the bay *de la Langosta*, for the admission of the sea winds, was recently finished. The population of this miserable town, inhabited almost exclusively by people of colour, amounts to 9000, at the time of the arrival of the Manilla galleon (*Nao de China*).—Its habitual population is only 4,(

Population.

Zacatula, a small sea-port of the South Sea, on the frontiers of the intendancy of Valladolid, between the ports of Siguantanejo and Colima.

Lerma, at the entry of the valley of Toluca, in a marshy ground.

Toluca (Tolocan) at the foot of the porphyry mountain of San Miguel de Tutucuitlalpilco, in a valley abounding with maize and maguey (agave).—Height 8813 feet.

Pachuca, with Tasco, the oldest mining-place in the kingdom, as the neighbouring village Pachuquillo is supposed to have been the first Christian village founded by the Spaniards.—-Height 8141 feet.

Cadereita, with fine quarries of porphyry of a clay base (*thonporphyr*).

San Juan del Rio, surrounded with gardens, adorned with vines and anona. Height 6489 feet.

Queretaro, celebrated for the beauty of its edifices, its aqueduct, and cloth manufactures. Height 6374 feet. Habitual population, 35,000

This city contains 11,600 Indians, 85 secular ecclesiastics, 181 monks, and 143 nuns. The consumption of Queretaro amounted in 1793 to 13,618 loads of wheaten flour, 69,445 bushels

of maize, 656 loads of chile (capsicum), 1770 barrels of brandy, 1682 beeves, 14,949 sheep, and 8869 hogs.

The most important mines of this intendancy, considering them only in the relation of their present wealth, are,

La veta Biscaina de Real del Monte, near *Pachuca*; *Zimapan*, *El Doctor*, and *Tehulilotepec*, near *Tasco*.

Diputaciones de Mineria, or Districts:

11. Pachuca.
12. El Doctor.
13. Zimapan.
14. Tasco.
15. Zacualpan.
16. Sultepec.
17. Temascaltepec.

Reales, or places surrounded by Mines:

Pachuca; Real del Monte; Moran; Atolonilco el Chico; Atolonilco el Grande; Zimapan; Lomo del Toro; Las Cañas; San Joseph del Oro; Verdozas; Capula; Santa Rosa; El Potosi; Las Plomosas; El Doctor; Las Alpujarras; El Pinal or los Amotes; Huascazoluya; San Miguel del Rio Blanco; Las Aguas; Maconi; San Christobal; Cardonal; Xacala; Jutchitlan el Grande; San Joseph del Obraje Viejo; Cerro Blanco; Cerro del Sotolar; San Francisco Xichu;

Jesus Maria de la Targea; Coronilla or la Purissima Concepcion de Tetela del Rio; Tepantitlan; San Vicente; Tasco; Tehuilotepec; Coscallan; Haucingo, Huautla; Sochipala; Tetlilco; San Esteban; Real del Limon; San Geronimo; Temas Caltepec; Real de Ariba; La Albarrada; Yxtapa; Ocotepec; Chalchitepeque; Zacualpan; Tecicapan; Chontalpa; Santa Cruz de Azulaques; Saltepec; Juluapa; Papaloapa; Los Ocotes; Capulatengo; Alcozauca; Totomixtlahuaca.

The mines of Pachuca, Real del Monte and Moran, are highly celebrated for their antiquity, their wealth, and their proximity to the capital. Since the beginning of the 18th century, the vein of La Biscaina, or Real del Monte has alone been wrought with activity. The working of the mines of Moran was resumed only within these few years; and the mineral depository of Pachuca, one of the richest in all America, has been wholly abandoned since the terrible fires which took place in the famous mine del Encino, which alone furnished more than 19,689lbs. troy weight of silver annually. The wooden work which supported the roof of the galleries was consumed by fire, and the greater number of the miners were suffocated before being able to reach the shafts. A similar conflagration in 1787 put a stop to the working of the mines of Bolaños, which were only again begun to be cleared out in 1792.

The valley of Mexico is separated from the

basin of *Totonilco el Grande*, by a chain of porphyritic mountains, of which the highest summit is the peak of the Jacal, elevated according to my measurement with the assistance of the barometer, 10,248 feet above the level of the sea. This porphyry serves for base to the porous amygdaloid, which surrounds the lakes of Tezcuco, Zumpango, and San Christobal. It seems to be of the same formation with that which, in the road from Mexico to Acapulco, immediately covers the granite between Sopilote and Chilpansingo, near the village of Acaguisotla, and l'Alto de los Caxones. To the north-east of the district of Real del Monte, the porphyry is at first concealed under the columnar basalt of the farm of Regla, and further on in the valley of Totonilco, under beds of secondary formation. The Alpine limestone of a greyish blue, in which is the famous cavern of Danto, called also the pierced mountain, or the Bridge of the Mother of God*, seems to repose immediately on the porphyry of Moran. It contains near the Puerto de la Mesa, veins of galena; and we find it covered with three other formations of not so old an origin, which, naming them in the order of their superposition, are Jura limestone, near the baths of Totonilco, the slaty limestone of Amojaque, and a gypsum of secondary formation mixed with clay. The position of these secondary rocks which

* *Puente de la Madre de Dios.*

I carefully observed, is so much the more remarkable, as it is the same with that which has been discovered on the Old Continent, according to the excellent observations of MM. de Buch and Freiesleben.

The mountains of the district of mines of Real del Monte, contain beds of porphyry, which, with respect to their relative antiquity, differ a good deal from one another. The rock which forms the roof and the wall of the argentiferous veins, is a decomposed porphyry, of which the base sometimes appears clayey and sometimes analogous to splintery hornstone. The presence of hornblende is frequently announced, merely by greenish stains intermingled with common and vitreous feldspar. At very great elevations, for example in the beautiful forest of oak and pine of Oyamel, we find porphyries with a base of pearl-stone, containing obsidian in layers and nodules.

What relation exists between these last beds, which several distinguished mineralogists consider as volcanic productions, and the porphyries of Pachuca, Real del Monte, and Moran, in which nature has deposited enormous masses of sulphuret of silver and argentiferous pyrites? This problem, which is one of the most difficult in geology, will only be resolved when a great number of zealous and intelligent travellers shall have gone over the Mexican Cordilleras, and carefully studied the immense variety of porphyries which are destitute

of quartz, and which abound both in hornblende and vitreous feldspar.

The district of mines of Real del Monte does not display—as at Freiberg in Saxony, Derbyshire in England, or as in the mountains of Zimapan and Tasco in New Spain—a great number of rich veins of small size, on a small tract of ground. It rather resembles the mountains of the Hartz, and Schemnitz, in Europe, or those of Guanaxuato and Potosi, in America, of which the riches are contained in a few mineral depositions of very considerable dimensions. The four veins of Biscaina, Rosario, Cabrera, and Encino, run through the districts of Real del Monte, from Moran and Pachuca, at extraordinary distances, without changing their direction, and almost without coming in contact with other veins which traverse or derange them.

The *veta de la Biscaina*, of less considerable dimensions, but perhaps still richer than the vein of Guanaxuato, was successfully wrought from the sixteenth to the beginning of the eighteenth century. In 1726 and 1727, the two mines of Biscaina and Xacal still produced together 333,969 ounces of silver. The great quantity of water which filtrated through the crevices of the porphyritic rock, joined to the imperfection of the means of drawing it off, compelled the miners to abandon the works when they were yet only 65 fathoms in depth. A very enterprising individual, Don Joseph

Alexandro Bustamente, was courageous enough to undertake a level near Moran; but he died before completing this great work, which is 7715 feet in length from its mouth to the point where it crosses the vein *de la Biscaina*. The direction of this vein is hor. 6; and its inclination is 85° to the south: its extent is from 13 to 19 feet. The direction of the porphyry of this district is generally hor. 7-8, with an inclination of 60° to the north-east, particularly in the road from Pachuca to Real del Monte. The level is at first cut through the solid rock (*querschlagsweise*) in a direction of hor. 7, towards the west; but further on it takes its way over three different veins, hor. 11-12, of which one alone, the *veta de le Soledad**, has furnished a sufficiency of silver ores to pay all the expenses of the undertaking. The level was only finished in 1762, by Don Pedro Tereros, the partner of Bustamente. The former, known by the title of Count de Regla as one of the richest men of his age, had already drawn, in 1774, a net profit of more than 1,041,750*l*. from the mine of Biscaina. Besides the two ships of war which he presented to King Charles the Third, one of them of 120 guns, he

* It is believed that this vein is the same with that which M. D'Eluyhar began to work in the pit of Cambrera, at Moran. It appeared to me, however, that the *veta de Cabrera* is rather the same with that of *Santa Brigida*, and that its principal wealth is to be found in following it towards the mine of Jesus.

lent 208,350*l.* sterling to the Court of Madrid, which have never yet been repaid him. He erected the great works of Regla at an expense of 416,700*l.* sterling; and he purchased estates of an immense extent, and left a fortune to his children, which has only been equalled in Mexico by that of the Count de la Valenciana.

The level of Moran traverses the vein of *La Biscaina*, in the San Ramon shaft, at a depth of 115 fathoms, below the level of the surface, on which the whims are placed. The profit of the proprietor has been annually diminishing since 1774. In place of driving levels for trial, to discover the vein on a great extent, they continued their sinking to a depth of nearly 53 fathoms below the level. At that depth the vein preserved its great wealth in sulphuret of silver mixed with native silver; but the abundance of water increased to such a degree that 28 whims, each of which required more than 40 horses, were not sufficient to draw it off. In 1783, the weekly expense amounted to 1875*l.* After the death of the old Count de Regla, the works were suspended till 1791, when they ventured to re-establish all the whims. The expense of these machines, which drew up the water not by means of pumps but by bags suspended by ropes, then amounted to more than 31,252*l.* per annum. At length they reached the deepest point of the mine, which according to my measurements is only 1064 feet above

the level of the lake of Zumpango; but the ores which they extracted did not compensate the expense of the process, and the mine was again abandoned in 1801.

It is surprising that they never thought of substituting for this wretched plan of drawing off the water by bags, proper pump apparatus put in motion by horse whims, by hydraulic wheels, or by machines moved by a column of water *(colonne d'eau)*. A level begun at Pachuca, or lower down towards Gazave in the valley of Mexico, would have exhausted the mine of Biscaina at the pit of San Ramon, for a depth of 202 fathoms. The same object could be attained at less expense by following the project of M. D'Elhuyar, in placing the mouth of a new level near Omitlan, in the road which leads from Moran to the place of amalgamation at Regla. This last level, before reaching 12,466 feet in length, would cut the vein of Biscaina.

The very wise plan which the Count de Regla at present follows is, to leave off the clearing of the old works, and to investigate the mineral repository, in points where it has never yet been worked (*in unverfahrenem felde*). In studying at Real del Monte the surface and undulations of the ground, we observe that the vein of Biscaina has furnished for three centuries its greatest riches from a single spot, that is to say, from a natural hollow (*enfoncement*) contained between the shafts

of Dolores, Joya, San Cayetano, Santa Teresa, and Guadalupe. The shaft from which the greatest quantity of silver ores has been extracted is that of Santa Teresa. To the east and west of this central point the vein is contracted for a distance of more than 1300 feet. It preserves its primitive direction, but becomes destitute of metals, and reduced to an almost imperceptible vein. For a long time it was believed that the vein of Biscaina was insensibly lost in the rock; but they discovered in 1798 very rich metals, at a distance of more than 1640 feet, to the east and west of the centre of the old works. They then sunk the shafts San Ramon and San Pedro, and discovered that the vein resumed its old power, and that an immense field was opened to new undertakings. When I visited the mines in the month of May 1803, the San Ramon shaft was then only 16 fathoms in depth; and it will be nearly 131 fathoms to the bottom of the level of Moran, which is itself still distant 147 feet from the point which corresponds to the intersection of the new shaft, and the roof of the level. In its present state, the mine of the Count de Regla annually yields more than from 30,000 to 40,000lbs. troy of silver.

The vein of Biscaina contains in the points of the principal mines, milk-quartz, which frequently passes into splintery hornstone, amethyst, carbonate of lime, a little sulphate of barytes, sulphuret of silver mixed with native silver, and sometimes pris-

matic black silver (*sprödglaserz*), deep-red silver, galena, and iron and copper pyrites. The same silver ores are found near the surface of the ground in a state of decomposition, and mixed with oxide of iron, like the *pacos* of Peru. Near the San Pedro shaft, the pyrites are sometimes richer in silver than the sulphuret of silver.

The mines of Moran, formerly of great celebrity, have been abandoned for 40 years, on account of the abundance of water which could not be drawn off. In this district of mines, which is in the vicinity of that of Real del Monte, near the mouth of the great level of Biscaina, there was placed in 1801 a machine *à colonne d'eau*, of which the cylinder is 10.23 inches in height, and 6.29 in diameter. This machine, the first of the kind ever constructed in America, is much superior to those of the mines of Hungary. It was executed agreeably to the calculations and plans of M. del Rio, professor of mineralogy in Mexico, who has visited the most celebrated mines of Europe, and who possesses at once the most solid and the most various acquirements. The merit of the execution is due to M. Lachausée, a Brabant artist of great talents, who has also fitted up for the school of mines of Mexico a very remarkable collection of models, for the use of students of mechanics and hydrodynamics. It is to be regretted that this fine machine, in which the regulator of the suckers is put in motion by a particular mechanism, was placed in a situation

where there is great difficulty in procuring a sufficiency of water to keep it going. When I was at Moran, the pumps could only work three hours a day. The construction of the machine and the aqueducts cost 10,937*l.* sterling: they did not at first calculate on more than half of the expense, and they imagined the mass of water to be very considerable; but the year in which the water was measured being exceedingly rainy, it was believed to be much more abundant than it actually was. It is to be hoped that the new canal which was going on in 1803, and which will be 16,404 feet in length, will remedy this want of water, and that the vein of Moran (hor. 9$\frac{1}{4}$ inclined 84° to the north-east), will be found as rich at great depths, as the shareholders of the mine suppose. M. del Rio, on my arrival in New Spain, had no other view but that of proving to the Mexican miners the effect of machines of this nature, and the possibility of constructing them in the country. This object has been in part attained; and it will be much more evidently attained when such a machine shall be placed in the mine of Rayas, at Guanaxuato, in that of the Count de Regla, at Real del Monte, or in those of Bolaños, where M. Sonneschmidt counted nearly 4000 horses and mules employed in moving the whims.

The mines of the *district of Tasco*, situated on the western slope of the Cordillera, have lost their ancient splendour since the end of the last century;

for in their present state the veins of Tehuilotepec, Sochipala, Cerro del Limon, San Estevan, and Gautla, do not altogether yield more than 36,923 lbs. troy of silver annually. During the year 1752 and the ten following years, the mines of Tasco were wrought with the greatest activity and success. This activity was owing to the enterprising mind of Joseph Laborde, a Frenchman, who came into Mexico very poor, and who in 1743 acquired immense wealth in the mine of la Cañada of the *Real de Tlapujahua*. We have already alluded to the reverses of fortune several times experienced by this extraordinary man. After building a church at Tasco, which cost him 87,507*l.* sterling, he was reduced to the lowest poverty, by the rapid decline of those very mines from which he had annually drawn from 130,000 to 200,000lbs. troy of silver. The archbishop having given him permission to sell a golden sun enriched with diamonds, with which he had adorned the tabernacle of the church of Tasco, he withdrew to Zacatecas with the produce of this sale, which amounted to 22,000*l.* sterling. The district of mines of Zacatecas was then so entirely neglected, that it scarcely furnished 33,000 lbs. troy of silver annually to the mint at Mexico. Laborde undertook to clear out the famous mine of Quebradilla; in which undertaking he lost all his property, without attaining his object. With the small capital which remained to him, he began to work on the *veta*

grande, and sunk the pit of *La Esperanza*; when a second time he acquired immense wealth. The silver produce of the mine of Zacatecas rose then to nearly 330,000 lbs. troy per annum; and though the abundance of metals did not long continue the same, he left at his death a fortune of nearly 125,000*l.* sterling. He compelled his daughter to enter into a convent, that he might leave his whole fortune to an only son, who afterwards voluntarily embraced the ecclesiastical office. In Mexico, and every where else in the Spanish provinces, it is extremely rare to see children following the profession of their fathers; and we do not find there, as in Sweden, Germany, and Scotland, families in which the business of miner is hereditary.

The veins of Tasco and the Real de Tehuilotepec traverse barren mountains, furrowed by very deep ravines.

The mining districts of Tasco and of the Real de Tehuilotepec contain a great number of veins, which, with the exception of the Cerro de la Compaña, are all directed from the north-west to the south-east, hor. 7—9. These veins, like those of Catorce, traverse both the limestone and the micaceous slate which serves for its base; and they exhibit the same metals in both rocks. These metals have been much more abundant in the limestone. The mines have become extremely poor since it became necessary to work the veins in the

micaceous slate. A very intelligent and very active miner, Don Vicente de Anza, wrought the mines of Tehuilotepec to the depth of 122 fathoms; and he cut two excellent levels for a length of 3,936 feet; but unfortunately he found that the same veins which had furnished considerable riches at the surface of the earth, were at great depths as poor in red silver ores, as they were abundant in galena, pyrites, and yellow blende.

An extraordinary event which happened on the 16th February 1802, completed the ruin of the miners of this district. The mines of Tehuilotepec, like those of Guautla, have at all times wanted the necessary water to put in motion the stamping mills and other machines which prepare the minerals for the process of amalgamation. The most abundant stream used in the works, issued from a cavern in the limestone rock called the *Cueva de San Felipe*. This rivulet was lost in the night between the 16th and 17th of February; and five days afterwards a new spring was found at five leagues distance from the cavern, near the village of Platanillo. It has been proved by researches of the greatest interest for geology, that there exists in this country, between the villages of Chamacasapa, Platanillo, and Tehuilotepec, in the bosom of calcareous mountains, a series of caverns and natural galleries, and that subterraneous rivers, like those of the county of Derby in England, traverse those galleries, which communicate with one another.

The veins of Tehuilotepec are in general western (*spathgänge*); they are from six to ten feet in extent, and being separated from the rock by a list of clayey loam, they form several lateral branches, which enrich the principal vein where they fall into it (*se trainent*). Their structure has this peculiarity, that the metallic mineral is rarely disseminated throughout all the lode, but is collected in a single band, which is sometimes near the roof, and sometimes near the wall of the vein. In general, the mineral depositories of Tasco and Tehuilotepec are extremely variable in their produce. As to the nature of the mass of which they are constituted, I perceived four very different formations of veins: viz.

1. Brown, red, and yellow oxides of iron, in which native and sulphuretted silver are disseminated in impalpable particles; cellular brown iron-stone, specular iron, a little galena, and magnetic iron, and blue carbonate of copper. This formation, analogous to that of the *pacos* of Fuentestiana, and Pasco in Peru, is designated at Tehuilotepec, by the name of *tepostel*. It is found at small depths from the surface (*in ausgehenden*) in the mines of San Miguel, San Estevan, and La Compaña, near Tasco, as well as at the Cerro de Garganta, near Mescala. The *tepostel* is generally not so rich as the Pasco of Peru; but is so much the richer at Tasco, as the oxide of iron is more mixed with azure of copper: it generally, however, does not

contain more than 80 ounces of silver per ton.

2. Calcareous spar, a little galena, and transparent lamellar gypsum, containing drops of water with air, and filiform native silver.

3. Light-red silver, brittle vitreous silver (*sprödglaserz*), much yellow blende, galena, very little of iron pyrites, calcareous spar, and milk-quartz. This formation, which is the richest of all, displays the remarkable phenomenon, that the minerals the most abundant in silver, form spheroidal balls, from 3.93 to 4.71 inches in diameter, in which red silver, mixed with brittle vitreous silver, and native silver alternate with bands of quartz. These balls, which have seldom been found but at a depth of from 50 to 200 feet, are nidulated in a course of calcareous and brown spar.

4. Much argentiferous galena, which is richer in silver in proportion as the detached pieces are of smaller grain; much yellow blende; little pyrites, quartz and calcareous spar, in the mines of Socabon del Re and de la Marquesa.

All these veins run through a table-land of from 5,550 to 5,910 feet elevation above the level of the sea, which enjoys a temperate climate very favourable to the cultivation of the grains of the old continent.

CHAPTER XV.

Intendancy of Guadalaxara—extent—climate—agricultural produce—principal towns—mines.

V. *Intendancy of Guadalaxara.*

Extent in north latitude.	Extent in west longitude.	Population in 1803.	Extent of surface in square miles.	No. of inhabitants to the square mile.
From 19° 0′ to 23° 12′	From 103° 30′ to 108° 0′	630,500	86,408	$7\frac{1}{3}$

THIS province, part of the kingdom of Nueva Galicia, has almost twice the extent of Portugal, with a population five times smaller. It is bounded on the north by the intendancies of Sonora and Durango, on the east by those of Zacatecas and Guanaxuato, on the south by the province of Valladolid, and on the west, for a length of coast of 370 miles, by the Pacific Ocean. Its greatest breadth is 300 miles, from the port of San Blas to the town of Lagos; and its greatest length is from south to

north, from the Volcan de Colima to San Andres Teal, 354 miles.

The intendancy of Guadalaxara is crossed from east to west by the Rio de Santiago, a considerable river which communicates with the lake of Chapala, and which will one day (in an advanced state of civilization) become interesting for internal navigation from Salamanca and Zelaya to the port of San Blas.

All the eastern part of this province is the table-land and western declivity of the Cordilleras of Anahuac. The maritime regions, especially those which stretch towards the great bay of Bayonne, are covered with forests, and abound with the finest wood for ship-building. The inhabitants of these districts are exposed to an unhealthy and excessively heated air. The interior of the country enjoys a temperate climate, favourable to health.

The Volcan de Colima, of which the position has never yet been determined by astronomical observations, is the most western of the volcanoes of New Spain which are placed on the same line in the direction of one parallel. It frequently throws up ashes and smoke. This insulated mountain appears only of a moderate height when its summit is compared with the ground of Zapotilti and Zapotlan, two villages of 5,503 feet elevation above the level of the coast. It is from the small town of Colima that the volcano appears in all its grandeur. It is never covered with snow, but when it

falls in the chain of the neighbouring mountains from the effects of the north wind.

According to a manuscript memoir communicated to the tribunal of the Consulado of Vera Cruz by the intendant of Guadalaxara, the value of the agricultural produce of this intendancy amounted, in 1802, to 569,000*l.* sterling; in which there were computed 1,657,000 bushels of maize, 43,000 loads of wheat, 17,000 *tercios* of cotton, and 20,000 pounds of cochineal of Autlan. The value of the manufacturing industry was estimated at 722,350*l.* sterling.

The province of Guadalaxara contains 2 ciudades, 6 villas, and 322 villages. The most celebrated mines are those of Bolaños, Asientos de Ibarra, Hostiotipaquillo, Copala, and Guichichila near Tepic.

The most remarkable towns are:

Guadalaxara, on the left bank of the Rio de Santiago, the residence of the intendant, of the bishop, and the high court of Justice (*Audicenia*).—Population 19,500

San Blas, a port, the residence of the *Departimiento de Marina*, at the mouth of the Rio de Santiago. The official people (*officiales reales*) remain at Tepic, a small town, of which the climate is not so hot and is more salubrious. Within these ten years the question has been discussed, if it would be useful to transfer the dock-yards, ma-

gazines, and the whole marine department from San Blas to Acapulco. This last port wants wood for ship-building. The air there is also equally unhealthy as at San Blas; but the projected change, by favouring the concentration of the naval force, would give the Government a greater facility in knowing the wants of the marine and the means of supplying them.

Compostella, to the south of Tepic. To the north-west of Compostella, as well as in the partidos of Autlan, Ahuxcatlan, and Acaponeta, a tobacco of a superior quality was formerly cultivated.

Aguas Calientes, a small well-peopled town to the south of the mines de los Asientos de Ibarra.

Villa de la Purificacion, to the north-west of the port of Guatlan, formerly called Santiago de Buena Esperanza, celebrated from the voyage of discovery made in 1532 by Diego Hurtado de Mendoza.

Lagos, to the north of the town of Leon, on a plain fertile in wheat on the frontiers of the intendancy of Guanaxuato.

Colima, two leagues south from the Volcan de Colima.

Diputaciones de Mineria, or Districts.

18. Bolaños.
19. Asientos de Ibarra.
20. Hostotipaquillo.

Reales, or places surrounded by Mines:—

Bolaños; Xalpa; San Joseph de Guichichila; Santa Maria de Guadalupe, or de la Yesca; Asi-

entos de Ibarra; San Nicolas de los Angeles; La Ballena; Talpan; Hostotipaquillo; Copala; Guaxacatan; Amaxac; Limon; Tepanteria; Iocotan; Tecomatan; Ahuatacancillo; Guilotitan; Platanarito; Santo Domingo; Iuchipila; Mezquital; Xalpa; San Joseph Tepostitlan; Guachinango; San Nicolas del Roxo; Amatlan; Natividad; San Joaquin; Santissima Trinidad de Pozole; Tule; Motage; Frontal; Los Aillo-Ezatlannes; Possesion; La Serranilla; Aquitapilco; Eliso; Chimaltitan; Santa Fe; San Rafael; San Pedro Analco; Santa Cruz de las Flores.

CHAPTER XVI.

Intendancy of Valladolid—extent—climate—Volcan de Jorullo—vegetable productions—earthquakes—volcanoes—population—principal towns—mines.

Extent in north latitude.	Extent in west longitude.	Population in 1803.	Extent of surface in square miles.	No. of Inhabitants to the square mile.
From 18° 25′ to 19° 50′	From 102° 15′ to 104° 50′	376,400	31,014	12

THIS intendancy at the period of the Spanish conquest made a part of the kingdom of Michuacan (Mechoacan), which extended from the Rio de Zacatula to the port de la Natividad, and from the mountains of Xala and Colima to the river of Lerma, and the lake of Chapala. The capital of this kingdom of Michuacan,—which, like the republics of Tlaxcallan, Huexocingo and Cholollan, was always independent of the Mexican empire,—was Tzintzontzan, a town situated on the banks of a lake singularly picturesque, called the lake of Patzquarro. Tzintzontzan, which the Aztec inhabitants of Tenochtitlan called Huitzitzila, is now only a poor Indian village, though it still preserves the pompous title of city (*ciudad*).

The intendancy of Valladolid, vulgarly called in the country Michuacan, is bounded on the north by the Rio de Lerma, which further east takes the name of Rio Grande de Santiago. On the east and north-east it joins the intendancy of Mexico; on the north the intendancy of Guanaxuato; and on the west that of Guadalaxara. The greatest length of the province of Valladolid from the port of Zacatula to the basaltic mountains of Palangeo, in a direction from S. S. E. to N. N. E. is 234 miles. It is washed by the South Sea for an extent of coast of more than 114 miles.

Situated on the western declivity of the Cordillera of Anahuac, intersected with hills and charming valleys, which exhibit to the eye of the traveller a very uncommon appearance under the torrid zone, that of extensive and well watered meadows,—the province of Valladolid in general enjoys a mild and temperate climate, exceedingly conducive to the health of the inhabitants. It is only when we descend the table-land of Ario and approach the coast, that we find a climate in which the new colonists, and frequently even the natives, are subject to the scourge of intermittent and putrid fevers.

The most elevated summit of the intendancy of Valladolid is the Pic de *Tancitaro*, to the east of Tuspan. To the east of the Pic de Tancitaro the *Volcan de Jorullo* (Xorullo, or Juruyo) was formed in the night of the 29th of September 1759. The great catastrophe in which this mountain rose from

the earth, and by which a considerable extent of ground totally changed its appearance, is perhaps one of the most extraordinary physical revolutions in the annals of the history of our planet.

This remarkable phenomenon has remained unknown to the mineralogists and naturalists of Europe, though it took place not more than fifty years ago, and within six days' journey of the capital of Mexico, descending from the central table-land towards the shores of the South Sea.

A vast plain extends from the hills of Aguasarco, to near the villages of Teipa and Petatlan, both equally celebrated for their fine plantations of cotton. This plain, between the *Picachos del Mortero*, the *Cerros de las Cuevas, y de Cuiche*, is only from 2,460 to 2,624 feet above the level of the sea. In the middle of a tract of ground in which porphyry with a base of *grünstein* predominates, basaltic cones appear, the summits of which are crowned with evergreen oaks of a laurel and olive foliage, intermingled with small palm-trees with flabelliform leaves. This beautiful vegetation forms a singular contrast with the aridity of the plain, which was laid waste by volcanic fire.

Till the middle of the 18th century, fields cultivated with sugar-cane and indigo occupied the extent of ground between the two brooks called Cuitamba and San Pedro. They were bounded by basaltic mountains, the structure of which seems to indicate that all this country at a very remote pe-

riod had been several times convulsed by volcanoes. These fields, watered by artificial means, belonged to the plantation (*hacienda*) of San Pedro de Jorullo, one of the greatest and richest of the country. In the month of June 1759, a subterraneous noise was heard: hollow noises of a most alarming nature (*bramidos*) were accompanied by frequent earthquakes, which succeeded one another for from 50 to 60 days, to the great consternation of the inhabitants of the *hacienda*. From the beginning of September every thing seemed to announce the complete re-establishment of tranquillity, when in the night between the 28th and 29th the horrible subterraneous noise recommenced. The affrighted Indians fled to the mountains of Aguasarco. A tract of ground from three to four square miles in extent, which goes by the name of *Malpays*, rose up in the shape of a bladder. The bounds of this convulsion are still distinguishable in the fractured strata. The *Malpays* near its edges is only 40 feet above the old level of the plain called the *playas de Jorullo*; but the convexity of the ground thus thrown up increases progressively towards the centre to an elevation of 524 feet.

Those who witnessed this great catastrophe from the top of Aguasarco assert that flames were seen to issue forth for an extent of more than half a square league, that fragments of burning rocks were thrown up to prodigious heights, and that through a thick

cloud of ashes, illumined by the volcanic fire, the softened surface of the earth was seen to swell up like an agitated sea. The rivers of Cuitamba and San Pedro precipitated themselves into the burning chasms. The decomposition of the water contributed to invigorate the flames, which were distinguishable at the city of Pascuaro, though situated on a very extensive table-land 4,600 feet elevated above the plains of *las playas* de Jorullo. Eruptions of mud, and especially of strata of clay enveloping balls of decomposed basaltes in concentrical layers, appear to indicate that subterraneous water had no small share in producing this extraordinary revolution. Thousands of small cones, from 6 to 10 feet in height, called by the natives ovens (*hornitos*), issued forth from the *Malpays*. Although within the last fifteen years, according to the testimony of the Indians, the heat of these volcanic ovens has suffered a great diminution, I have seen the thermometer rise to 202° Fahr. on being plunged into fissures which exhale an aqueous vapour. Each small cone is a *fumorola*, from which a thick vapour ascends to the height of 40 or 50 feet. In many of them a subterraneous noise is heard, which appears to announce the proximity of a fluid in ebullition.

In the midst of the ovens, six large masses elevated from 1,300 to 1,600 feet each above the old level of the plains, sprung up from a chasm, of which the direction is from N.N.E. to S.S.E. This

is the phenomenon of the Montenovo of Naples, several times repeated in a range of volcanic hills. The most elevated of these enormous masses, which bears some resemblance to the *puys* de l'Auvergne, is the great Volcan de Jorullo. It is continually burning, and has thrown up from the north side an immense quantity of scorified and basaltic lavas containing fragments of primitive rocks. These great eruptions of the central volcano continued till the month of February 1760. In the following years they became gradually less frequent. The Indians, frightened at the horrible noises of the new volcano, abandoned at first all the villages situated within seven or eight leagues distance of the *playas* de Jorullo. They became gradually, however, accustomed to this terrific spectacle; and having returned to their cottages, they advanced towards the mountains of Aguasarco and Santa Iñes, to admire the streams of fire discharged from an infinity of great and small volcanic apertures. The roofs of the houses of Queretaro were then covered with ashes at a distance of more than 144 miles in a straight line from the scene of the explosion. Although the subterraneous fire now appears far from violent, and the Malpays and the great volcano begin to be covered with vegetables, we nevertheless found the ambient air heated to such a degree by the action of the small ovens (*hornitos*), that the thermometer at a great distance from the surface and in the shade, rose as high as

109° Fahr. This fact appears to prove that there is no exaggeration in the accounts of several old Indians, who affirm that, for many years after the first eruption, the plains of Jorullo, even at a great distance from the scene of the explosion, were uninhabitable from the excessive heat which prevailed in them.

The traveller is still shown, near the Cerro de Santa Iñes, the rivers of Cuitamba and San Pedro, the limpid waters of which formerly watered the sugar-cane plantation of Don André Pimentel. These streams disappeared in the night of the 29th September 1759; but at a distance of 6,560 feet further west, in the tract which was the theatre of the convulsion, two rivers having the appearance of mineral waters, in which the thermometer rises to 126°.8 Fahr., are now seen bursting through the argillaceous vault of the *hornitos*. The Indians continue to give them the names of San Pedro and Cuitamba, because in several parts of the Malpays great masses of water are heard to run in a direction from east to west, from the mountains of Santa Iñes towards *l'Hacienda de la Presentacion*. Near this habitation there is a brook, which disengages itself from the sulphureous hydrogen. It is more than 21½ feet in breadth, and is the most abundant hydro-sulphureous spring which I have ever seen.

In the opinion of the Indians, these extraordinary transformations which we have been de-

scribing,—the surface of the earth raised up and burst by the volcanic fire, and the mountains of scoria and ashes heaped together,—are the work of the monks; the greatest, no doubt, which they have ever produced in the two hemispheres! In the cottage which we occupied in the *playas* de Jorullo, our Indian host related to us, that in 1759, Capuchin missionaries came to preach at the plantation of San Pedro, and not having met with a favourable reception (perhaps not having got so good a dinner as they expected), they poured out the most horrible and unheard-of imprecations against the then beautiful and fertile plain, and prophesied, that in the first place the plantation would be swallowed up by flames rising out of the earth, and that afterwards the ambient air would cool to such a degree that the neighbouring mountains would for ever remain covered with snow and ice. The former of these maledictions having already produced such fatal effects, the lower Indians contemplate in the increasing coolness of the volcano the sinister presage of a perpetual winter. I have thought proper to relate this vulgar tradition, because it forms a striking feature in the picture of the manners and prejudices of these remote countries. It proves the active industry of a class of men who too frequently abuse the credulity of the people, and pretend to suspend by their influence the immutable laws of Nature for the sake of founding their empire on the fear of physical evils.

The extent of the intendancy of Valladolid is one-fifth less than that of Ireland; but its relative population is twice as large as that of Finland. In this province there are 3 *ciudades* (Valladolid, Tzintzontzan, and Pascuaro); 3 *villas* (Citaquaro, Zamora, and Charo); 263 villages; 205 parishes; and 326 farms. The imperfect enumeration of 1793 gave a total population of 289,314 souls, of whom 40,399 were male Whites, and 39,081 female Whites; 61,352 male Indians, and 58,016 female Indians; and 154 monks, 138 nuns, and 293 individuals of the secular clergy.

The Indians who inhabit the province of Valladolid form three races of different origin;—the Tarascs, celebrated in the sixteenth century for the gentleness of their manners, for their industry in the mechanical arts, and for the harmony of their language, abounding in vowels; the Otomites, a tribe yet very far behind in civilization, who speak a language full of nasal and guttural aspirations; and the Chichimecs, who, like the Tlascaltecs, the Nahuatlacs, and the Aztecs, have preserved the Mexican language. All the southern part of the intendancy of Valladolid is inhabited by Indians. In the villages the only White figure to be met with is the *curé*, and he also is frequently an Indian or Mulatto. The benefices are so poor there, that the bishop of Mechoacan has the greatest difficulty in procuring ecclesiastics to settle in a country where Spanish is scarcely ever spoken, and where, along

the coast of the Great Ocean, the priests, infected by the contagious miasmata of malignant fevers, frequently die before the expiration of seven or eight months.

The population of the intendancy of Valladolid decreased in the years of scarcity of 1786 and 1790; and it would have suffered still more, if the respectable bishop of the diocese had not made extraordinary sacrifices for the relief of the Indians. He voluntarily lost in a few months the sum of 9,600*l.* sterling, by purchasing 50,000 bushels of maize, which he sold at a reduced price, to keep within bounds the sordid avarice of several rich proprietors, who, during that epoch of public calamities, endeavoured to take advantage of the misery of the people.

The most remarkable places of the province of Valladolid are the following:

Valladolid de Mechoacan, the capital of the intendancy and seat of a bishop, which enjoys a delicious climate. Its elevation above the level of the sea is 6,396 feet; and yet at this moderate height, and under the 19° 42′ of latitude, snow has been seen to fall in the streets of Valladolid. This sudden change of atmosphere, caused, no doubt, by a north wind, is much more remarkable than the snow which fell in the

Population.

streets of Mexico the night before the Jesuit fathers were carried off! The new aqueduct by which the town receives potable water, was constructed at the expense of the last bishop, Fray Antonio de San Miguel, and cost him nearly 21,000*l.* sterling. 18,000

Pascuaro, on the banks of the picturesque lake of the same name, opposite to the Indian village of Janicho, situated at a distance of two or three miles, on a charming little island in the midst of the lake. Pascuaro contains the ashes of a very remarkable man, whose memory, after a lapse of two centuries and a half, is still venerated by the Indians,—the famous Vasco de Quiroga, first bishop of Mechoacan, who died in 1556 at the village of Uruapa. This zealous prelate, whom the natives still call their father (*Tata don Vasco*), was more successful in his endeavours to protect the unfortunate inhabitants of Mexico than the virtuous bishop of Chiapa, Bartholomé de las Casas. Quiroga became in an especial manner the benefactor of the Tarasc Indians, whose industry he encouraged. He prescribed one particular branch of commerce to each Indian village.

	Population.
These useful institutions are in a great measure preserved to this day. The height of Pascuaro is 7,217 feet.	6,000
Tzintzontzan, or Huitzitzilla, (the old capital of the kingdom of Mechoacan,) of which we have already spoken.	2,500

The intendancy of Valladolid contains the mines of Zitaquaro, Angangueo, Tlapuxahua, the Real del Oro, and Ynguaran.

Diputaciones de Mineria, or Districts.

33. Angangueo.
34. Inguaran.
35. Zitaquaro.
36. Tlalpujahua.

Reales, or places surrounded by Mines:

Angangueo; El Oro; Tlapaxahua; San Augustin de Ozumatlan; Zitaquaro; Istapa; Los Santos Reyes; Santa Rito de Chirangangeo; El Zapote; Chachiltepec; Sanchiqueo; La Joya; Paquaro; Xerecuaro; Curucupaseo; Sinda; Inguaran; San Juan Guetamo; Ario; Santa Clara; Alvadeliste; San Nicolas Apupato; Rio del Oro; Axuchitlan; Santa Maria del Carmen del Sombrero; Favor; Chichindaro.

CHAPTER XVII.

Summary recapitulation.—physical aspect—climate—territorial extent—population—agriculture—mines—manufactures—commerce—revenue—military defence.

Summary recapitulation.

HAVING presented our readers with all the details which appeared relevant to the purpose of this work, we will now briefly recapitulate what has been said concerning the present state of Mexico.

Physical aspect.—In the centre of the country a long chain of mountains runs first from the south-east to the north-west, and afterwards beyond the parallel of 30° from south to north; vast table-lands stretch out on the ridge of these mountains, gradually declining towards the temperate zone; under the torrid zone their absolute height is from 7,550 to 7,870 feet. The ascent of the Cordilleras is covered with thick forests, while the central table-land is almost always arid and destitute of vegetation. The most elevated summits, many of which rise beyond the limits of perpetual snow, are crowned with oak and pine. In the equinoctial region the different climates rise as it were by strata one above another: between the 15° and 22° of

latitude, the mean temperature of the shore, which is humid and unhealthy for individuals born in cold countries, is from 77° to 80° Fahr.; and that of the central table-land, which is celebrated on account of the great salubrity of the air, is from 60° to 62°. There is a want of rain in the interior, and the most populous part of the country is destitute of navigable rivers.

Territorial extent. — One million sixty-two thousand square miles, of which two thirds are under the temperate zone; the other third, lying under the torrid zone, from the great elevation of its table-lands, enjoys generally a temperature similar to that which is experienced in spring in Spain and the south of Italy.

Population.—Five millions eight hundred and forty thousand inhabitants; whereof two millions and a half are copper-coloured Indians, one million Mexican Spaniards, seventy thousand European Spaniards; scarcely any Negro slaves. The population is concentrated on the central table-land. The clergy alone consists of fourteen thousand individuals. The population of the capital 135,000 souls.

Agriculture.—The banana, the manioc, maize, cerealia, and potatoes, are the foundation of the nutriment of the people. The cerealia cul-

tivated under the torrid zone, wherever the surface rises from 3,900 to 4,300 feet of elevation, produce twenty-four for one. The maguey (*agave*) may be considered as the Indian vine. The cultivation of sugar-cane has lately made a rapid progress; and Vera Cruz annually exports Mexican sugar to the value of 282,000*l*. The finest cotton is produced on the western coast. The cultivation of cocoa and indigo is equally neglected. The vanilla of the forests of Quilate produces annually 900 *millares*. Tobacco is carefully cultivated in the districts of Orizaba and Cordova; wax abounds in Yucatan; the cochineal harvest of Oaxaca amounts to 880,000 lbs. per annum. Horned cattle have greatly multiplied in the *Provincias internas* and on the eastern coast between Panuco and Huasacualco. The tithes of the clergy, the value of which points out the increase of territorial produce, have increased two-fifths within the last ten years.

Mines.—Annual produce in gold, 4,289lbs. troy; in silver, 1,439,832lbs.; in all, to the value of 5,000,000*l*. sterling, or nearly the half of the precious metals annually extracted from the mines of North and South America. The mint of Mexico has furnished, from 1690 to 1803, more than 293,150,000*l*.; and from the discovery of New Spain to the commencement of the nineteenth century, probably 878,800,000*l*., or nearly two fifths of

the entire quantity of gold and silver which in that interval of time has flowed from the New Continent into the Old. Three districts of mines, Guanaxuato, Zacatecas,and Catorce, which form a central group between the 21° and 24° of latitude, yield nearly the half of all the gold and silver extracted from the mines of New Spain. The vein of Guanaxuato alone, richer than the mineral depository of Potosi, furnishes at an average 286,000 lbs. troy of silver annually, or a sixth of all the silver which America annually throws into circulation. The single mine of Valenciana, in which the expense of working exceeds 180,000*l.* per annum, has for the last forty years never ceased to yield annually to the proprietors a net profit of more than 120,000*l.*: this profit has sometimes amounted to 240,000*l.*; and it amounted to 800,000*l.* in the space of a few months for the family of Fagoaga at Sombrerete. The produce of the mines of Mexico has tripled in fifty-two years, and sextupled in a hundred years; and it will admit of greater increase as the country shall become more populous and industry and information be more diffused. The working of the mines, far from being hostile to agriculture, has favoured cultivation in the most uninhabited regions. The wealth of the Mexican mines consists more in the abundance than in the intrinsic riches of the silver minerals, which amount at an average only to ·0002 (or from 60 to 80 ounces per ton). The quantity of minerals extracted

by means of mercury is to that produced by smelting in the proportion of $3\frac{1}{2}$ to 1. The process of amalgamation used is long, and occasions a great waste of mercury: the consumption for all New Spain amounts to 1,540,000 lbs. per annum. It is to be presumed that the Mexican Cordilleras will one day supply the mercury, iron, copper, and lead, necessary for internal consumption.

Manufactures.—Value of the annual produce of manufacturing industry from 1,500,000*l.*, to 1,700,000*l.* The manufacture of hides, cloth, and calicoes, has been on the increase since the conclusion of the last century.

Commerce.—Importation of foreign produce and goods, 4,400,000*l*; exportation in agricultural produce and manufactures of New Spain, 1,300,000*l.* The mines produce in gold and silver 5,000,000*l.*, of which about 1,750,000*l.* are exported on account of the king: consequently if we deduct from the remaining 3,250,000*l.*, 3,034,000*l.* to pay the excess of imports over the exports, we find the specie of Mexico hardly increases 216,000*l.*

Revenue.—The gross amount of the revenue is 4,400,000*l.*; whereof 1,192,000*l.* from the produce of the gold and silver mines, 816,000*l.* from the tobacco farm, 650,000*l.* from the alcavalas,

282,000*l.* from the Indian capitation tax, and 173,000*l.* from the duty on *pulque* or fermented juice of the agave.

Military defence.—It consumes the fourth of the total revenue. The Mexican army is 30,000 strong, whereof scarcely a third are regular troops, and more than two thirds militia. The petty warfare continually carried on with the wandering Indians in the *provincias internas*, and the maintenance of the *presidios* or military posts, require a very considerable expense. The state of the eastern coast and the configuration of the surface of the country facilitate its defence against any invasion attempted by a maritime power.

ADDENDA.

Since my return to Europe I have received the following particulars, which carry on our information on the subjects in question to the year 1806.

The road from Vera Cruz to Xalapa, and from thence to Perote, begun in the month of February 1803, has been continued with great activity. It was executed in 1806, between las Vigas and la Rinconada, for a length of 79,228 varas, or 198,601 feet. As the work was executed by a great number of condemned criminals, an hospital was established at la Rinconada, capable of receiving 1700 patients. The arches of the bridge of the Rio de la Antigua, begun near the Ventilla, were destroyed by the extraordinrry swell which took place in 1806. The *Consulado* of Vera Cruz immediately constructed new pillars, more solid than the former and closer to each other. The beautiful giratory light-house (*fanal de la Vera Cruz*), of which I have spoken, was completed in the month of May 1804. It will require nearly 650*l.* annually keep it up.

Notwithstanding the rise in the price of iron, the working of the mines has been continued with the same activity as before the commencement of the

last war. There has been coined at the mint of Mexico in gold and silver;

In 1804,—5,201,687*l.*; in 1805,—5,885,942*l.*; in 1806,—5,359,471*l.*

Of the 5,201,687*l.* coined in 1804; 5,094,483*l.*, or 1,696,404lbs. troy were silver, and 107,187*l.* or 2,235lbs. troy were gold.

The coinage of the year 1805 has even exceeded that of 1796. The extraordinary increase of the public revenue since the commencement of the eighteenth century, as well as the augmentation of tithes of which we have already spoken, proves the progress of population, great commercial activity, and the increase of national wealth.

THE END.

Printed by Richard Taylor,
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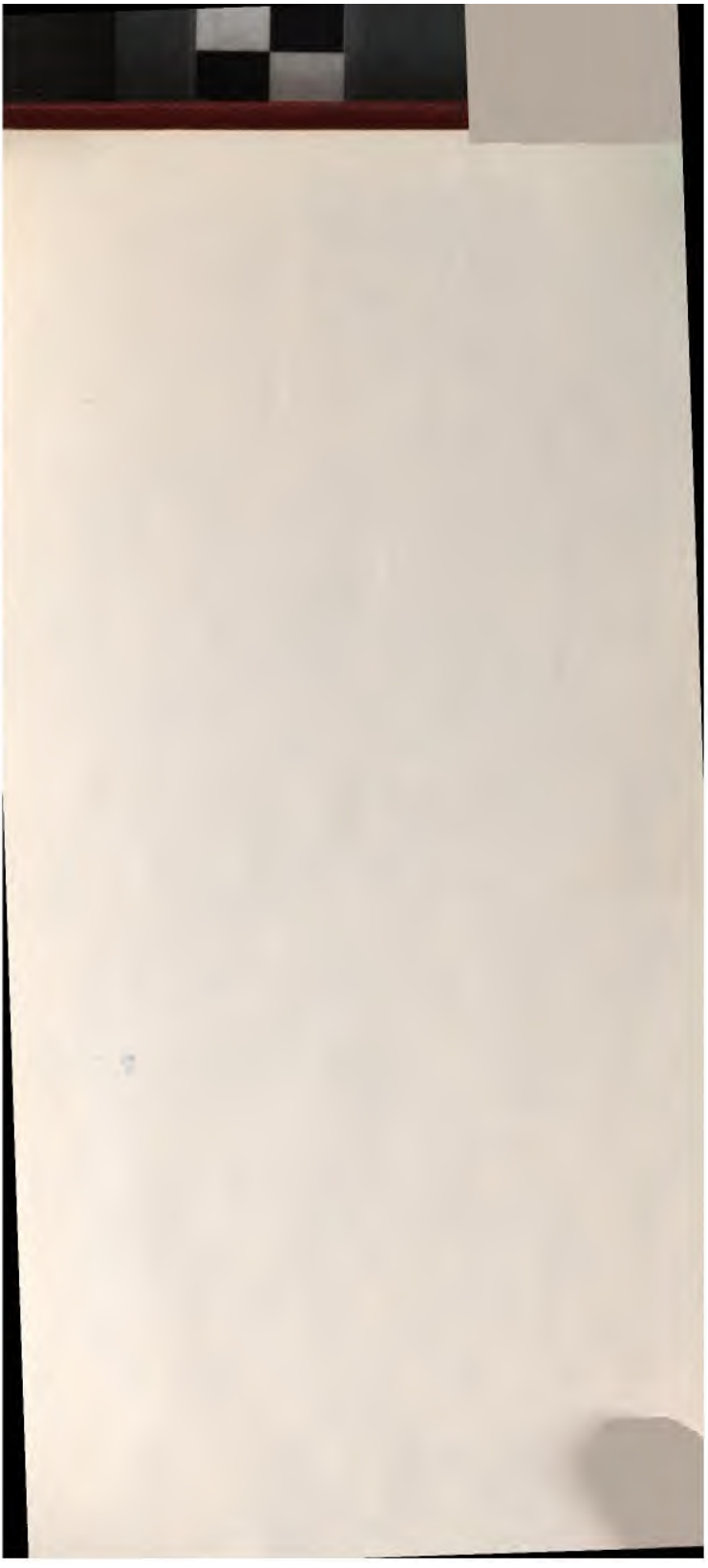

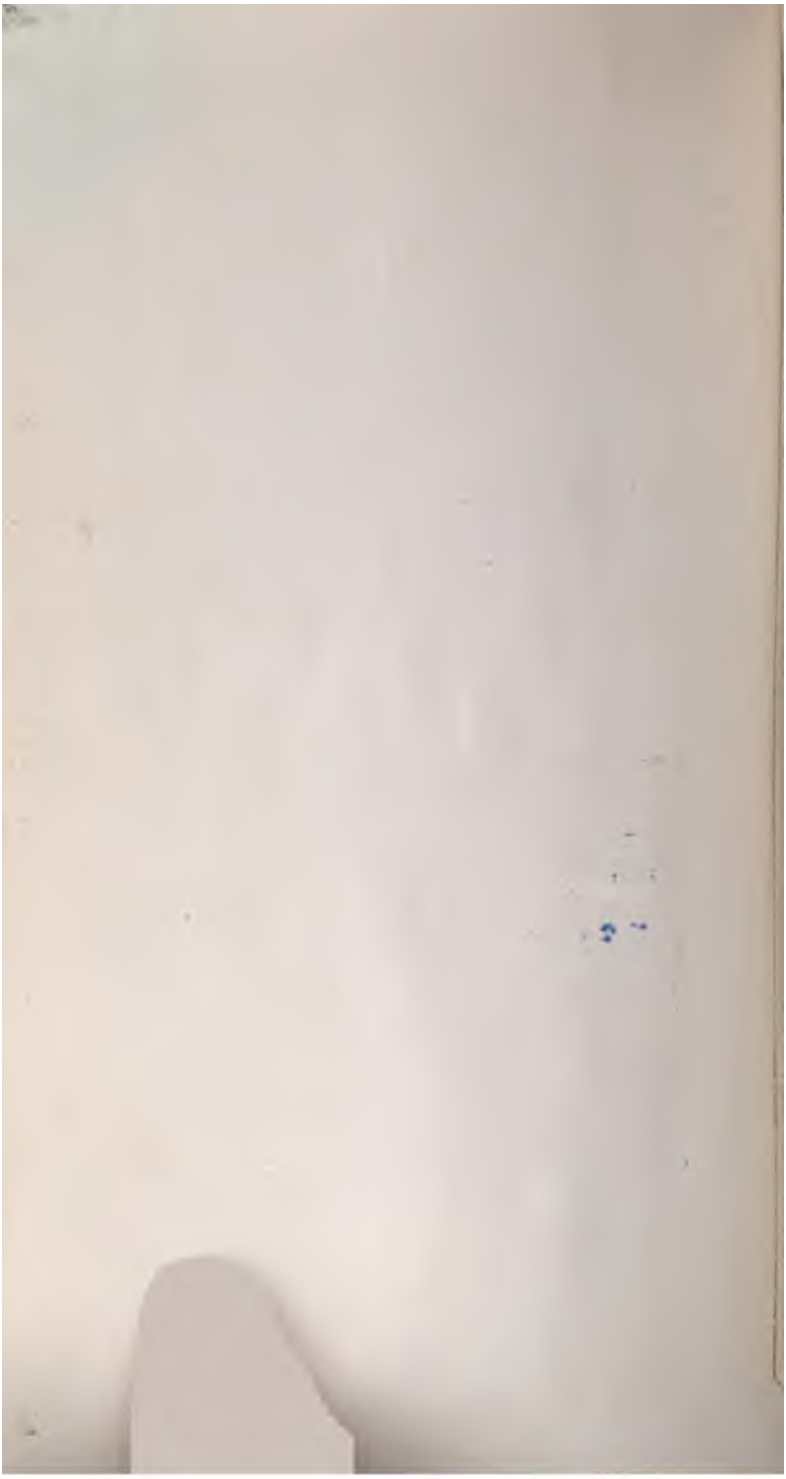

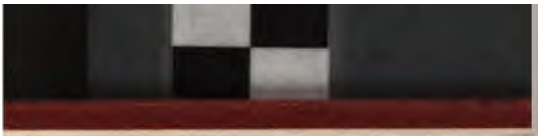

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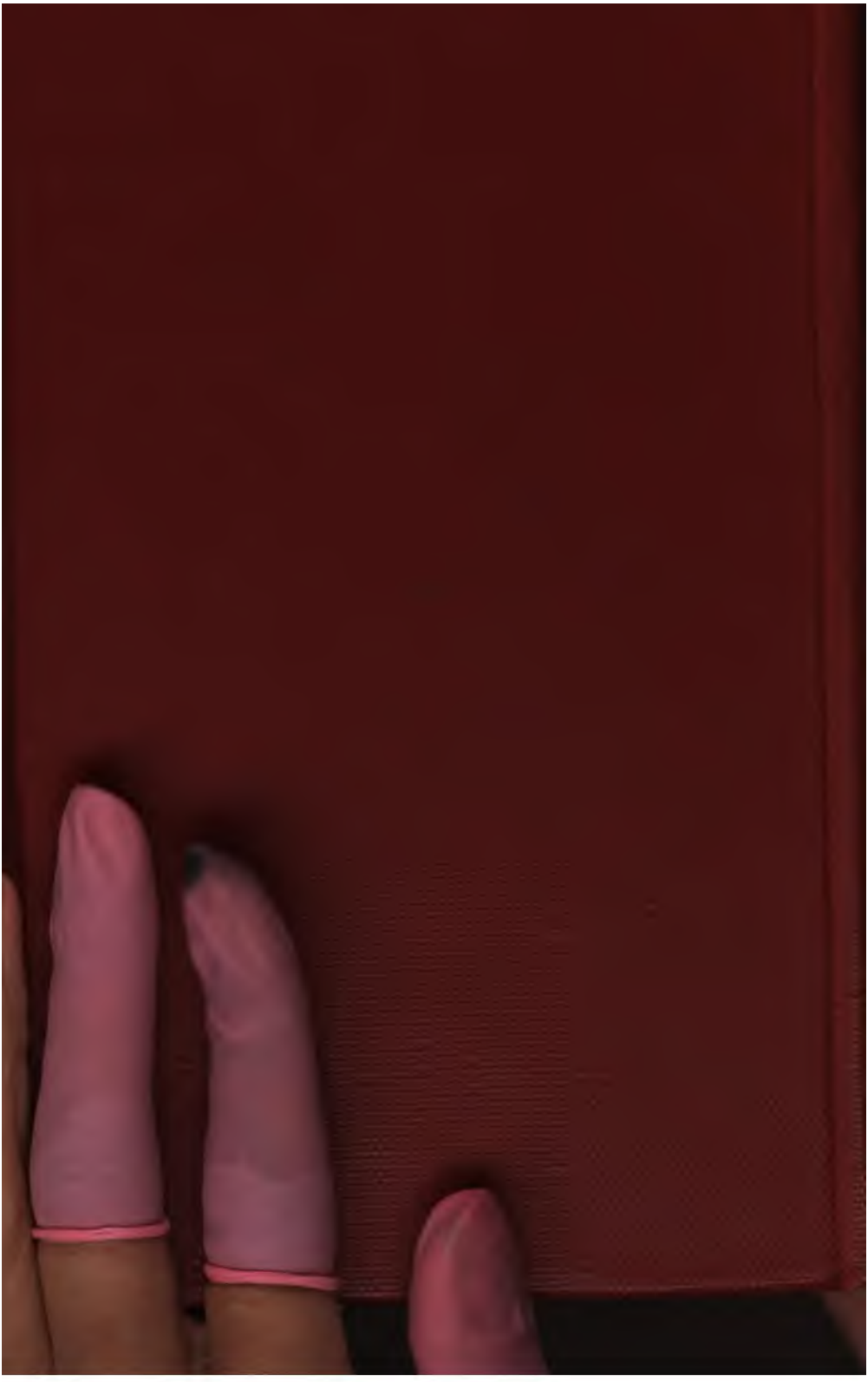
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